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Planning for Future Coal Supply

MILDER weather and freer freight movement should not blind public utility companies to the continued seriousness of the fuel situation. Experience is a stern teacher and a sure guide. The co-operation of state fuel administrators should therefore be sought at once in planning for the coal supply of the future. Storage in quantities should be resorted to whenever feasible, but it ought to be and is possible so to co-ordinate production and distribution that a constant and regular supply of fuel will be assured to public utilities. If the various state electric associations will make a serious survey of the situation and with the assistance of railroad operators and the state fuel administrators evolve a practical plan of operation, serious shortage next winter will be avoided. The time to take action on such a plan, however, is now.

Brighter Prospect for Western Water Powers

WITHIN the last few weeks there has been notable improvement in the prospect for hydroelectric power development on the Pacific Coast. Drastic action by the fuel administrators—and finally urgent recommendation from these sources for the utilization of hyroelectric power to the maximum—put the water-power question in a new light. Just such a radical turn of affairs has been needed for some time if water-power projects are to be brought back into popular favor, but it remains to be seen whether the improvement in the situation has been great enough to insure that funds for development will be forthcoming. Certain it is, however, that fuel shortage has greatly improved the status of the undeveloped water-power project, and if rate increases comparable with the increased cost of production are allowed by public utility commissions there is a prospect for considerable activity in hydroelectric development. A significant point is that under the new conditions encouragement is given to municipal projects in the same degree as to private ventures, so that several dormant municipal ownership schemes have been brought forward and now give every promise of becoming live issues.

In most of the Pacific Coast centers practically all available power has been absorbed or spoken for, and as new developments have not been numerous of late considerable additions to the total power available are not in prospect, as is usually the case. In the city of Los Angeles it is being urged that funds be made available for the development of additional aqueduct power; the city of Seattle is going ahead on an ambitious scheme of development on the Skagit River which will doubtless appear in a very favorable light under present conditions, and power companies all along the coast have been taking account of stock and making estimates as to what additional power can be most quickly made available and what it will cost to add it to the system. In the San Francisco district, where the power companies are now combined under one administrative head, each company has submitted to the Railroad Commission a memorandum of additional power possibilities, and these will doubtless be considered collectively with the good of the combined systems in mind. For some time water-power development has been discouraged by the government regulations and restrictions which hedged it about, has been looked upon with disfavor by capitalists, and under adverse rate conditions even developed powers have been unable to offer attractive profits to stockholders. Now conditions are changing. It is to be earnestly hoped that a new order of things will be established judiciously and on a basis such that the much-needed water-power development will be encouraged and aided.

Broader Aspects of Research Work

THE annual report of the president of the Carnegie Foundation, Dr. Robert S. Woodward, contains much of interest to those concerned with the broader aspects of scientific research. The report shows clearly the part which an endowed altruistic organization may play in guiding and promoting investigations of value. Dr. Woodward deprecates the division of research into scientific and industrial and of the sciences into pure and applied. In his opinion both phrases have been turned to account in setting up invidious distinctions inimical to the progress of all concerned. The principal harm probably lies in causing mutual misunderstanding and even alienation between the pure scientist and the applied technologist. The engineer begrudges the physicist and the mathematician their hair-splitting involved writings in which he cannot find a simple relationship needed for the practical problem on hand; while they look askance at and deplore his inaccurate short-cut methods and empirical recipes.

Invidious distinctions of this kind ought not, however, to be longer countenanced. Students should early be taught that the whole store of human knowledge is their property, and that any of it or any of its exponents and specialists may be called upon to assist in the solution of a particular practical problem. With the words "pure" and "applied" dropped, the interests

of both science and industry will materially gain. An optimist who is looking for beneficial results of the great war may point with satisfaction to an active participation of pure scientists in the most important practical problems of the day. Proposed investigations should be characterized as something more definite than "industrial" or "scientific." There should be an infinite number of gradations, rather than two opposite classes.

President Woodward touches a sore spot when in speaking of fallacies he says: "The worst of all these fallacies is found in the not unpopular notion that if experts could be set at work under the direction of inexperts great progress could be achieved. This is the fallacy so often used to justify placing technical work under the administration of politicians and promoters rather than under the charge of competent men." The difficulty, however, lies in the definition of "competent" men under whom research men can thrive and achieve their best. The man who is too much of a researcher himself in some one line may not be competent or sympathetic enough to judge about other lines, and he probably loves his own problem too well to spend much time in supervision and administrative work. On the other hand, a foreman with a stop-watch, an administrator with "vim and vigor," is sure to alienate his scientists and to discourage them. At least some of them will degenerate into "getting results," turning out papers and reports in quantity without much regard to permanent value and quality. And yet, while it is difficult to describe an ideal type of administrator, we have splendid examples like Dr. Whitney of the General Electric Company or Dr. Stratton of the Bureau of Standards. A two-faced Janus, a double personality, is needed, one who is an investigator and an organizer at the same time, saturated with judgment and sympathy and boiled in tact.

Speaking of normal investigators as distinct from pseudo-scientists who apparently bother the Carnegie Foundation sorely, Dr. Woodward strikingly characterizes the latter in one short sentence: "The pseudo-scientist is in general excessively egoistic, secretive, averse to criticism and almost always unaware of the work of his predecessors and contemporaries in the same field." While this may be true of pseudo-scientists, the opposite statement does not always hold true. Not every one who exhibits some of the above-mentioned sins is necessarily an impostor or a low-grade worker. Secretiveness is often imposed by commercial considerations, by modesty, cautiousness, or by the lack of literary ability. A lack of sympathy or interest in advanced investigations on the part of the reading public sometimes accounts for the seeming secretiveness. Again, one sometimes finds a surprising ignorance of the literature of the subject on the part of a high-grade original worker and an extensive knowledge of bibliography among mere compilers, imitators and hack writers. The two probable reasons are a woeful lack of reading knowledge of foreign languages and an absorbing interest in a problem that makes the researcher too stingy of his time to read what others have done. A brilliant research worker often needs a business manager to guide him, to force him to read about other people's work, and to advertise him and his writings. Such a business manager might well underscore in blue pencil some parts of Dr. Woodward's report and lay it on his ward's desk.

Skill Is Needed in Employment Methods

THE demand for skilled employment managers is far greater than the supply. With an apparent labor shortage the wisdom of putting each man in his best place, of giving him the highest type of work he is capable of doing, of encouraging him to improve himself, has been apparent. Intelligent employment methods must become universal. They are necessary for the development of the highest efficiency of the individual as an individual and as a member of an industrial organization. Moreover, they bring employee and employer into close, sympathetic touch. Each will profit from the experience of the other. Such contact, too, is a necessary preparation for the inevitable—co-operative management. Any scheme that is not based on confidence and sympathy will fail.

Uses of the Graphic Meter

A PAPER on the applications of the graphic meter to motor practice by Professor Clewell points a moral, to wit, that it is always wise before undertaking a motor-drive equipment to find out what the real conditions are rather than to rely upon assumptions. In the early days of motor applications the besetting sin of everyday practice was installation of motors considerably too large for the job. This fault was generally an unhappy inheritance from steam-engine practice, in which it was a custom to install an engine as large as would probably be needed and then a couple of sizes larger still for good measure. The result was an uneconomical load all the time, of which the user of the engine was seldom cognizant. Indicators were looked upon as scientific playthings by most manufacturers, and all that anybody knew definitely about the amount of power used was the rating of the engine. When the electric motor came along there was a very strong tendency on the one hand to order, and on the other to sell, a machine of about the same rated output as the previous engine without further investigation. The penalty paid for this indiscretion was high first cost, low efficiency, and in the case of alternating-current motors abominably low power factors. Later people began to make experimental tests of the power actually required, and then reform began. Professor Clewell's paper brings out very forcibly the importance of the graphic meter in finding out exactly not only the output which may be required but also the distribution of that output through the day's work, often economically more important than the actual work required. In these days, when charges for electrical energy are commonly based on demand as well as energy required, the nature of that demand is of large economic importance, and this is precisely what the graphic meter provides ready to hand. It shows not only how much energy is required but hour by hour the probable range of variations. Indeed, it goes further and gives an exceedingly good line on the general activities of the shop, sometimes with results important to the cost of production.

There are two general varieties of graphic meters, each of them important in its own sphere and considerably used. The familiar dial instruments are extremely convenient for rough determinations of demand in terms of time, and from their simplicity they can be

very handily used in keeping records over a considerable period. While not attempting accurately to register the quick variations which sometimes appear, for many uses they are quite sufficient. The curve-drawing instruments working on a continuous roll capable of a variety of speeds and giving results in rectangular coordinates which can readily be graphically integrated meet another class of requirements—those which require a close measurement of power involving quick variations. Cases of this sort arise in connection with some machine tools having a cycle of operations in which the input is necessarily very variable from time to time. Such graphical instruments often give extremely valuable hints for improvements in design and management. Their place is to fill the gaps necessarily left by the simpler and rougher recorders whenever close analysis becomes necessary. Both classes of recorders have their necessary uses, and both should be employed much more frequently than they are, even at the present time when their value has already become well established. Examples given by Professor Clewell as to the kind of information obtainable from these graphical records make their importance clear.

The Columbus Generating Station

THOSE of our readers who are interested in the organization and performance of stations of medium size will read with appreciation the details of the new Columbus (Ohio) plant. Perhaps its most striking feature is its location about 10 miles (16 km.) from the center of the city, where coal and water are readily available. The old-time central station, planted of necessity near the center of load, is gradually passing away; but it is still a little unusual to find a plant for city service deliberately put out where it belongs, and located primarily for good generating conditions, in full realization of the fact that power transmission makes such a location in every way available. Incidentally, the new plant does a considerable transmission business at distances further than Columbus itself. The equipment is a typical one—modern turbo-generators and water-tube boilers—and one of the incidental advantages of an out-of-town location shows in the ground plan layout, all on one floor, which considerably simplifies the care of apparatus.

A sign of the times which should be well heeded is the preparation which has been made for fuel supply. Two 400-ton steel bunkers are being constructed just outside the boiler room, filled by conveyors through a coal crusher and then by tilting with bucket elevators. An electric traveling larry takes charge of the coal at the bunkers for distribution to the stokers along the firing aisle. These bunkers are merely for temporary supply, and further continuity of action is guaranteed by the storage yard outside, capable of keeping in stock three or four months' supply. This is crossed by an elevated railway from which the coal can be dumped into storage and there distributed or reloaded by a locomotive crane with a grab bucket. The water supply is also well cared for, the source being the river, and it is worth noting that a water-purifying system with two 20,000-gal. tanks is in use to insure the quality of the feed water. The electrical part of the system is along familiar lines, except that the primary voltage is 4150 on a four-wire distribution system, a step upward which could advantageously be taken more often than it is.

Adapting Induction Meters to Different Frequencies

WHEN an alternating-current distributing system changes the frequency impressed by the generators between the limits of 25 and 60 cycles the incandescent lamps and the heaters connected to the system remain unchanged. It is true that the incandescent lamps may give evidence of a flicker at low frequencies, but ordinarily this is not serious. The motors connected to the system, however, require to be changed. The integrating energy meters or watt-hour meters, being motor devices, are also thrown out of calibration by a large change of system frequency, unless they happen to be commutator-motor meters capable of being operated either on continuous or on alternating-current circuits. The ordinary alternating-current induction meter, which is not serviceable on continuous-current circuits, is thrown out of calibration by a marked change of frequency.

The experience of one utility company in regard to the recalibration of its induction meters, when changing its frequency first from 60 cycles to 25 cycles and then, after two years, back again from 25 cycles to 60 cycles, is described in this issue by E. L. Fischer. It is shown that whereas a meter can be adapted to such an increase of frequency by adjustment and recalibration, it can ordinarily only be adapted to such a decrease of frequency by changing the shunt coils as well. In other words, induction meters will suffer a large rise in frequency without change of parts, but not a large fall in frequency. As the meter question is only one of the difficulties that accompany a change in central-station impressed frequency, the manager who undertakes such a change deserves sympathy and condolence.

The Coming Issues

METHODS of improving economy of operation and construction and of utilizing labor and materials efficiently are uppermost in the minds of utility managers to-day. Two articles dealing with such matters will be published shortly. One will show how to utilize second-hand line material and the other will treat of heat insulation as a solution of the fuel problem. Another very timely article will dwell on the selection, lay-out, application and tests of motor and control apparatus in the plate shop of a recently equipped shipbuilding company. The principles involved will, of course, be equally applicable to many other machine shops. Since the effects of temperature and aging have a bearing on the behavior and performance of all electrical apparatus, the application of a series-inductance bridge for measuring insulation capacity and dielectric energy loss at low frequencies and high-potential gradients, which will also be described in an early issue, will be of interest to electrical engineers. An analysis of the building-heating problem in large cities, made with reference to the distribution of power from central stations, is also to be published soon, and in view of recent experiences should prove of peculiar interest.

Interconnection of Plants in Massachusetts

Spreading Rapidly Through the State, Especially in the Eastern and Central Areas, the Interconnection of Generating Systems Is Recognized as an Economic Movement of Great Importance

This description of progress in the interconnection of generating systems in Massachusetts is another indication of a policy which is receiving increasing attention as a means of conserving fuel and power. The possibilities of interconnection in California and New York were described in the ELECTRICAL WORLD of Jan. 5, 1918, page 12.

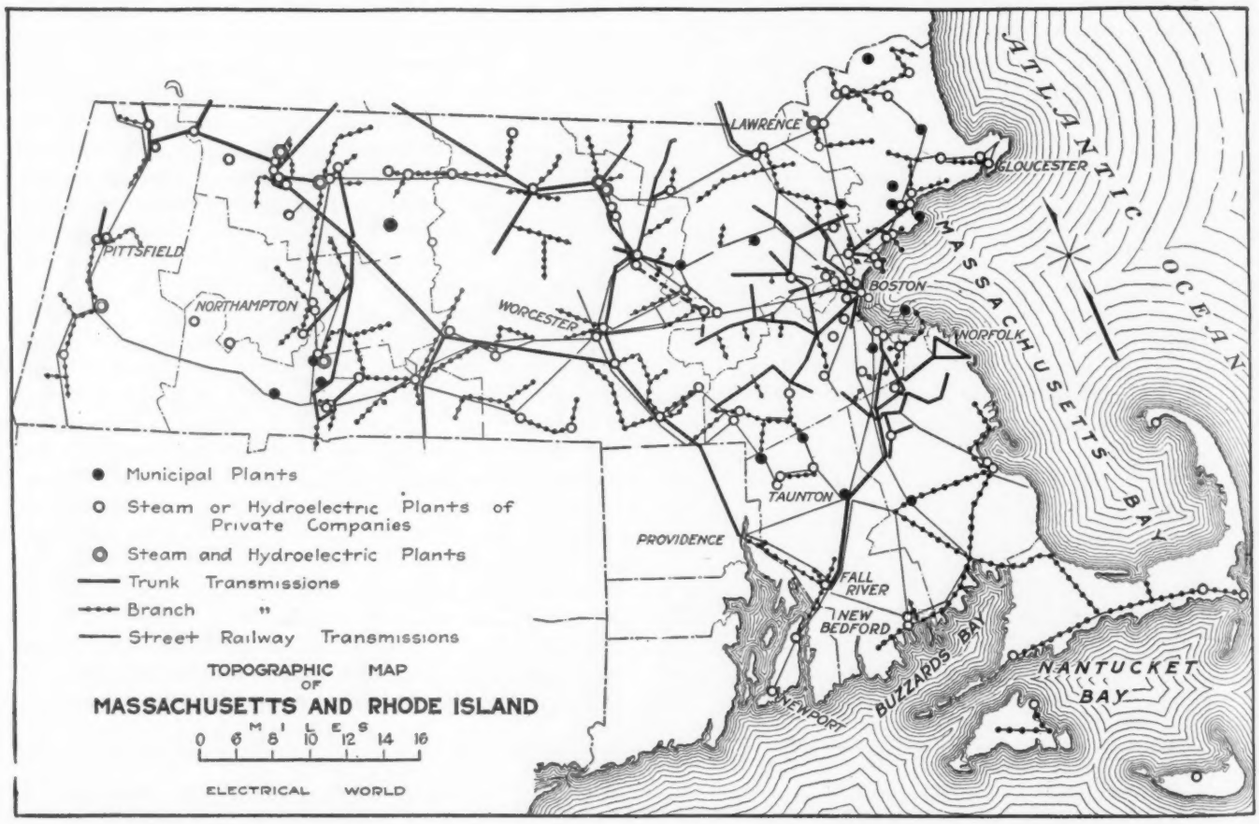
THROUGH the courtesy of the New England Fuel Administration, the accompanying map is presented of all the electric system interconnections in Massachusetts up to date, including hydroelectric transmission lines, central stations, municipal electric plants and street railways.

The map is arranged to show these lines schematically only; it was not designed to exhibit their correct geographical location. Taken by and large, however, it shows that interconnection is now spreading rapidly through Massachusetts, especially in its eastern and central areas. The State is about 200 miles (321.8 km.) long on its east and west axis, with an average width of about 60 miles (96.5 km.).

The street railway transmission lines are in general a little less conspicuous on the map than the lines of the interconnected electric supply utilities, and many of the former are operated at 25 cycles. Sixty cycles is the standard frequency of virtually all the Massachusetts central stations and also of the large transmission companies, the chief of which are the New England Power Company and the Turners Falls Power & Electric Company. Seventeen municipal plants are shown on the map.

The largest central station in the State is that of the Edison Electric Illuminating Company of Boston, and the transmission network radiating from this plant, at L Street, South Boston, serves almost half a hundred municipalities. This system will be connected shortly through the dotted transmission line shown in the east central part of the State with the Metropolitan Water Board's hydroelectric plant at Clinton and thus with the lines of the New England Power Company. This does not mean the entrance of hydroelectric energy into Boston on any considerable scale for the present, but if economic considerations justify it, there appears no serious engineering difficulty.

A recently planned connection is one between the Boston Edison system and that of the Tenney syndicate of central stations north of Boston, embracing Malden, Revere and Salem. Running from northwest to southeast is the transmission system of the New England Power Company, forming trunk lines connected with many local central stations, electric railways and also interconnected with the Turners Falls system at Leverett, in the Connecticut Valley. These lines extend



(Prepared by F. E. Frothingham for the Public Utilities Committee of the New England Fuel Administration)

from the Deerfield Valley diagonally across Hampshire and Worcester Counties to the Rhode Island line, where the transmission is extended through the Pawtucket-Woonsocket district to the system of the Narragansett Electric Lighting Company, in Providence, the largest steam relay on the New England Power Company's lines.

From the upper border of Massachusetts a trunk line of this system extends from the Vernon hydroelectric plant through northern and central Worcester County to the operating center at Millbury, outside Worcester, the two trunk line systems being joined here and also looped through Vernon to the Deerfield Valley district. Branch transmission lines extend from the trunks at various points to the Berkshire district in the western part of the State to Camp Devens (the Ayer cantonment), to central stations operated by C. D. Parker & Company of Boston, in central and southeastern Massachusetts, and with connections to the central-station companies at Fitchburg, Worcester, Clinton, Marlboro, Southbridge and other places.

The Turners Falls system is confined chiefly to the Connecticut Valley, in the Springfield-Greenfield district, including both hydroelectric plants and steam relays. Through the interconnection switching station at Leverett a factor of safety of great value has been introduced with respect to wholesale energy supply, as well as an economic opportunity for the best utilization of diversity factors.

Electrical continuity is now a fact from Williamstown (the seat of the college headed by Fuel Administrator Garfield), in the extreme northwestern corner of the State, to Narragansett Bay, Rhode Island, and this will be true soon of the reach from Williamstown to tidewater at Boston.

The map shows that much remains to be done in the way of interconnecting local central stations and municipal plant systems with one another, and that the Gas and Electric Light Commission will find itself provided with no small task if its request to the Legislature goes through for power to order interconnections and the curtailment or shutdown of inefficient stations.

TYPICAL BENEFITS FROM PLANT INTERCONNECTION

How a 6000-Kw. Station in Massachusetts Gets Energy at 25 Per Cent Less than It Could Produce It—Other Advantages

A transmission line will be completed in the near future between the turbine station of the Narragansett Electric Lighting Company at Providence, R. I., and the plant of the Attleboro Steam & Electric Company at Attleboro, Mass., which will illustrate in a marked degree the advantages of central-station interconnection where one of the plants is relatively small. Before the line could be built it was necessary to obtain the approval of the Massachusetts Gas and Electric Light Commission. In sanctioning the work the commission said in part:

"The present industrial activity and the difficulties in securing coal have emphasized the desirability and even necessity of so co-ordinating the developed sources of power, both steam and hydroelectric, throughout the State by connecting lines as to utilize existing plants and introduce substantial economies in their operation and future investment. The undertaking in question is a step in this direction, and the board has no hesitation in authorizing the construction of the line."

Despite the war, the business of the Attleboro company in supplying power to jewelry-manufacturing plants and other customers within its territory has increased during the past year. The generating capacity of the Attleboro company's station is 3000 kw., one 1500-kw. and two 750-kw. turbines being in service. The peak load is about 1900 kw., and the load is increasing rapidly for the size of the station. A study of the growth of load indicates that the Attleboro company would be obliged to expend $630,000 within the next twenty years to meet its increasing business if this were done by progressively enlarging its own station.

The company's total output last year was about 4,000,000 kw.-hr., and the rate of annual increase in business during the past decade has been about 8.5 per cent in station output. The present cost of production is about 1.13 cents per kilowatt-hour.

Negotiations with the Naragansett company, one of the largest central-station organizations in New England, led to an agreement for the purchase of energy from the Providence tidewater station and for the construction of a 35,000-volt transmission line between the systems of the two companies. The capacity of the line is to be 20,000 kw. at 35,000 volts, but for the present it will be operated at 22,000 volts, and not more than 5000 kw. will be required.

The general plan, starting from the Narragansett company's plant, is to furnish energy through underground cables to its East Providence substation, thence carrying the line overhead along the right-of-way of a branch of the New Haven Railroad and northerly across country to the steam plant of the Attleboro company. The total length of line is about 12 miles (19.3 km.) from the East Providence substation to Attleboro, where an outdoor substation is provided in the plan for receiving energy from the line at an estimated investment cost of about $35,000. The estimated cost per mile, including material and labor but exclusive of right-of-way of the two-circuit, overhead 22,000-volt line is $6,396.12.

At the outdoor substation in Attleboro about 5000 kw. in transformer capacity is to furnish the initial installation, with switchboard equipment to handle 10,000 kw. It is expected that this installation will not have to be enlarged for over a decade. For all energy supplied the Attleboro company is to pay the Narragansett company at the rate of 8.57 mills per kilowatt-hour, measured on the secondary side of the transformers in the Attleboro plant, with an adjustment for coal price variation and for any energy produced by other means than coal. The base price per kilowatt-hour is to be increased or decreased 0.085 mill for every 10 cents' variation from the base price of $3.50 a ton for coal. The agreement, which has a life of twenty years from May, 1917, provides for the retention and maintenance of the turbine-driven units of the Attleboro company in the station of the latter, so that energy may be supplied reciprocally to the Narragansett company whenever necessary or desirable. Attleboro is not on tidewater, and by purchasing energy the company saves a 60-cent-per-ton freight rate on coal from Providence.

Columbus Company's Idea of a Modern Station

Plant Established Outside City—Relatively Large Generators—Unit Arrangement in Boiler Room—Almost Exclusive Use of Motor-Driven Auxiliaries—Considerable Electric Equipment Outdoors

UNTIL recently Columbus, Ohio, and many cities like it have been served by generating stations situated very close to or somewhere near the load center of the district served. Owing to the effect which lack of coal storage space and scarcity of a supply of good boiler-feed water will have on the reliability of service and performance of the plant, however, it is usually better to locate the power station outside of the district served and where railroad facilities, plenty of room for coal storage and ample supply of water are available. Because of the developments in transmission equipment which make it unnecessary to locate a generating station at or near the center of distribution, the Columbus Railway, Power & Light Company was able to forget the old requirements influencing the location of generating stations and has recently put in operation its first generating station to be placed outside the city limits, where both coal and water are available. The plant is situated 10 miles (16 kw.) southeast of the center of the city. In addition to furnishing energy for the light, power and railway requirements of the city and in a number of towns within a radius of 15 miles (24 km.) of Columbus, the plant also supplies considerable energy for Camp Sherman at Chillicothe and to the cities of Chillicothe and Circleville, 50 miles (80 km.) south of Columbus.

Among the features of the station are the following: The generating units are rather large (18,750 kva.) for the community served. The steaming equipment is arranged in units of two boilers and one economizer each, the economizer having approximately 71 per cent of the heating surface of the two boilers. With the underfeed stokers provided a maximum output of 340 per cent normal rating is effected. The economizer arrangement is such that access is obtained from outside of the building. The brick wall of the building is omitted opposite each economizer, and asbestos sectional covers are used instead. This arrangement economizes floor space and makes the economizers easily accessible for inspection or repair. All steam piping is provided with steel flanges and Vanstone joints. Welded nozzles are used wherever possible to eliminate the joints and to make piping compact. The coal-handling equipment is notable in that it involves the minimum number of conveyors. No manual labor is required for handling the ashes.

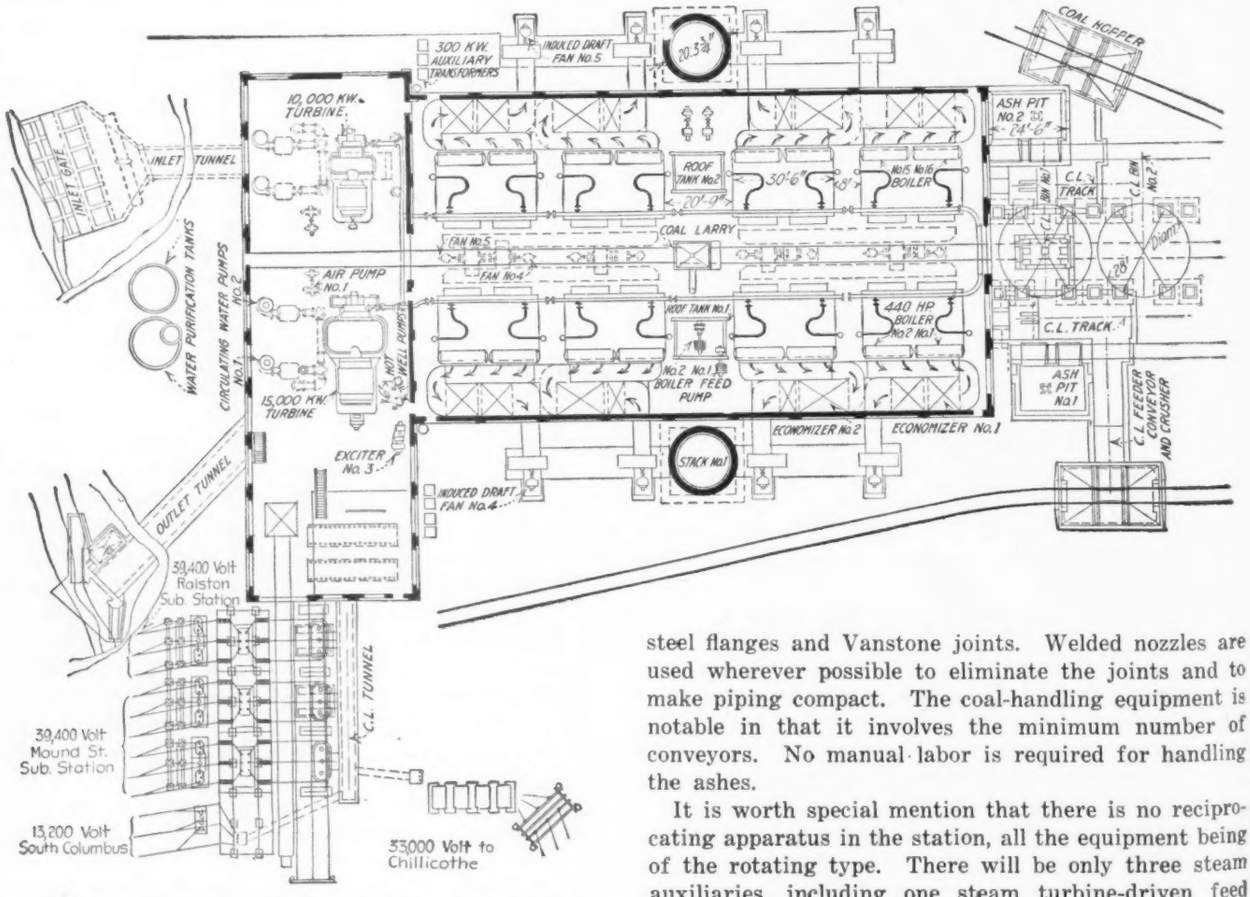


FIG. 1—LAYOUT OF STATION EQUIPMENT AND OUTDOOR ELECTRICAL APPARATUS

It is worth special mention that there is no reciprocating apparatus in the station, all the equipment being of the rotating type. There will be only three steam auxiliaries, including one steam turbine-driven feed pump and two steam-driven dry-vacuum pumps. All other auxiliary equipment is driven by induction motors, the majority of which are of the adjustable-speed type. Every motor and turbine, including the generating units, has flexible couplings.

Very little space is required within the station for electrical equipment, only the generator-voltage switches being installed indoors. All transformers, high-voltage

bus structures, main-line switches and lightning arresters are situated outdoors, but any of this equipment can be cut out of service and transported into the station for inspection and repair, thus securing all the advantages of the outdoor type of electrical equipment with minimum disadvantages.

Since the station is situated so far from the center of distribution, energy will be carried into the city over

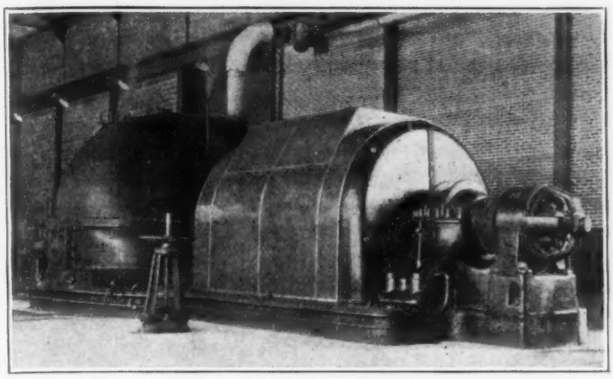


FIG. 2—EMERGENCY EXCITATION FOR THIS GENERATOR CAN BE FURNISHED BY TURBO-EXCITER

three transmission-line circuits at 39,400 volts and over one circuit at 13,200 volts (the latter being generator voltage), which will feed an industrial section at the extreme south end of the city relatively near the station. That part of the station which is in operation consists principally of one 18,750-kva. turbine and eight 440-hp. boilers. Two 13,200/39,400-volt, 15,000-kva., three-phase, water-cooled outdoor transformers will be used for the present, a 12,500-kva. turbine and eight additional boilers will be installed early this year, and a third transformer will be installed at a later date.

In general the plant is laid out with the idea of having all equipment that requires constant attention on the main floor level. This applies to switchboards, turbines, motors for driving circulating-water pumps and hot-well pumps, controllers for all fan and stoker drives, battery-charging sets, etc. Therefore there will be little occasion for the operators to leave the main floor.

Coal and Ash Handling Arrangement

When the station is completed two 400-ton cylindrical steel coal bunkers will be provided just outside of the boiler room at the end of the station. Coal will be supplied to these bunkers from track hoppers, the coal passing by means of a flight conveyor through a coal crusher, thence by bucket elevators to the top of the coal bunkers. From the bunkers the coal will be carried into the boiler room by means of a 4½-ton electric traveling larry, which runs along the middle of the firing aisle so that it can be used to supply stokers on both sides when additional boilers are installed. Track scales (Fairbanks-Morse) are provided immediately under one of the coal bunkers so that the fuel can be accurately weighed as it is being carried into the station. The larry has a revolving bin, which works like a turret, and is provided with a screw conveyor which supplies the coal to the stokers. The coal bunkers, crusher and larry are of the Jeffrey type.

While the bunkers will have sufficient capacity to keep the station operating one to two days, irregularities of shipments are guarded against by providing space for three or four months' supply of coal outside the plant. An elevated track supported on reinforced-concrete piers extends over this storage space so that very little labor will be required in unloading the coal cars, as most of the fuel is received in hopper-bottom cars. The coal will be distributed over the ground and reloaded in the cars for moving into the station by means of a 15-ton Brown steam-driven locomotive crane provided with a 2-yd. (1.5-cu. m.) grab bucket.

Steaming Equipment

The boiler plant will consist of sixteen Babcock & Wilcox boilers having 4440 sq. ft. (408 sq. m.) of heating surface apiece. Single-loop superheaters which will give about 150 deg. superheat under average conditions are also provided. Boilers are designed for 250-lb. (17.8-kg.) steam pressure and are provided with Diamond mechanical soot blowers, Copes feed-water regulators, Balanced Draft regulators for opening the outlet dampers and Bailey furnace meters which record the steam flow, air flow to the boilers, the temperature of the exhaust gases and also the draft under the boilers. Each boiler has one eight-retort Sanford-Riley underfeed stoker, with which it is expected to obtain 340 per cent normal rating of the boilers.

The gases from each battery of boilers pass through one Green fuel economizer, being conveyed thereto by means of 5/16-in. (4.93-mm.) steel-plate flues covered with 1.5-in. (38.1-mm.) heat insulation. From the economizers the gases are conveyed to the smokestacks through uncovered steel breechings, the draft being assisted by Green induced-draft fans placed outside the building and driven by adjustable-speed Lincoln motors. Two concrete chimneys will be provided, each chimney accommodating eight boilers or four batteries of boilers. The forced-draft fans for each battery boiler (part Green and part Sturtevant with General Electric

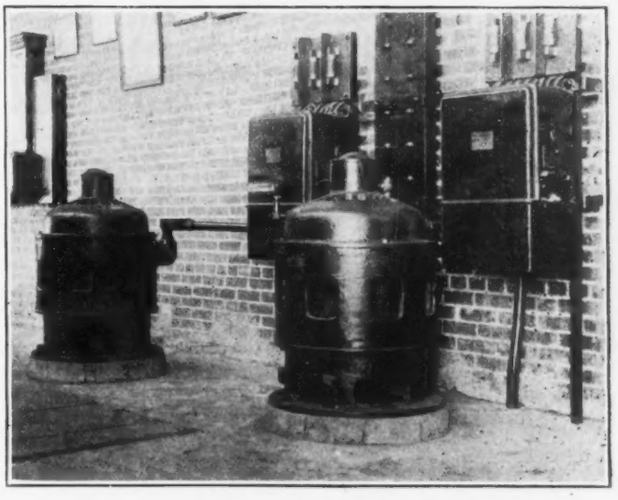


FIG. 3—DUPLICATE VERTICAL-SHAFT MOTORS DRIVING CIRCULATING PUMPS

motors) are installed inside the station below the firing aisle.

It is expected to operate each battery of boilers with its corresponding fans and economizers continuously. When necessary to make extensive repairs the entire unit will shut down, although, of course, either one of the boilers may be shut down for cleaning without dis-

turbing the operation of the other. The controllers for all of the stokers and fans, which are motor-driven, are situated conveniently to the boilers, where they will be under the control of the boiler-room operators. Large steps in the adjustment of drafts will be obtained

FIG. 4—POTENTIAL-TRANSFORMER SIDE OF BUS STRUCTURE

by changing the speed of the fan motors and by the movement of the dampers in the air ducts.

Steam from the boilers will be carried through 6-in. (15-cm.) steam lines to the main 12-in. (30-cm.) steam header. Each row of eight boilers will be provided with a 12-in. (30-cm.) steam header, the two headers being connected together at each end of the station so as to form a complete ring. The feed water will be supplied to the boilers from water heaters arranged in a similar manner.

The economizers, which have no by-passes, are operated in parallel and feed directly into the feed-water header. To avoid unequal feeding from the economizers, Monel metal orifices are provided in the feed-water header between the connections to the economizer. To insure fine adjustment of the feed to the economizers it is the intention to regulate the opening of the valves in the connections between the economizers and the header, determining the adjustment of these valves by the temperature of the feed water leaving the economizers as shown by Bristol recording thermometers. In addition to the Bailey recording furnace meters, there are Bristol recording thermometers for the gases leaving the economizers and for the water entering and leaving the economizers, also for the water entering the feed-water heater.

The foundations for the boilers, which are of concrete, form the ash pits. Two drag-chain conveyors pass under each row of eight boilers, conveying the ashes out to the end of the station and discharging them into a clinker crusher, which in turn discharges into the boot of a bucket elevator. This equipment is also of the Jeffrey type. The elevator may discharge either into a concrete ash pit or railroad car or wagon. For some time it will be possible to dispose of the ashes around the property, as considerable grading can be done. While each drag-chain has sufficient capacity for carrying out the ashes produced, duplicate conveyors are furnished so as to allow repairs and changes to be made without interrupting operation.

THE WATER SYSTEM

The circulating water for the Alberger surface condenser under each turbine will be supplied by duplicate vertical-shaft, adjustable-speed, motor-driven Wood circulating-water pumps. These pumps receive water from a gravity tunnel which runs under the entire length of the turbine room. After passing through the condensers, the circulating water discharges into another gravity tunnel which also runs the full length of the turbine room and carries the water out into the river at a point about 160 ft. (48.7 m.) below the intake. Each condenser is provided with duplicate motor-driven single-stage centrifugal Alberger condensate pumps. The concrete tunnels under the turbine room eliminate the usual large amount of piping required for circulating water and also supply the water at convenient points with minimum waste of power. The discharge water lines from the condensers are sealed in the discharge tunnels so that advantage is taken of the siphon action.

The intake end of the tunnel is enlarged and provided with large racks. Six large removable wire baskets are also provided to catch leaves, twigs, etc., which may come down-stream during high water. Each basket is in a separate compartment provided with a gate for shutting off the flow of water when the basket is raised for cleaning. A traveling hoist is provided for operating the gates and baskets. Particles that pass through the baskets and racks can be removed before reaching the condenser by means of Elliott twin strainers, which are installed between the circulating-water pumps and the condensers. The circulating-water pumps are installed immediately on top of the intake tunnels, with their shafts vertical, so that a minimum suction lift of about 11 ft. (3.3 m.) is secured.

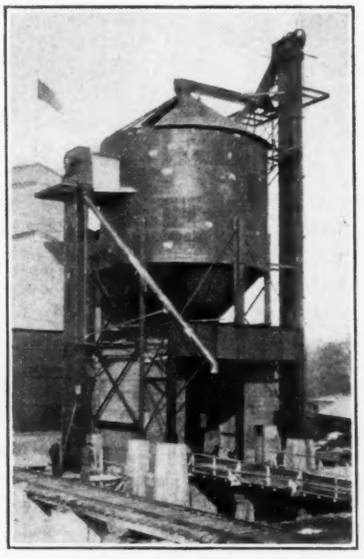


FIG. 5—HOPPER OUTSIDE STATION WHICH RECEIVES COAL FROM CARS DUMPED BENEATH

The condenser of the 18,750-kva. unit, now installed, is bolted directly to the exhaust flange of the turbine and supported on car springs so as to avoid the use of expansion joints. These springs will allow the condenser to expand when it becomes heated.

The condensate from the condenser is forced by centrifugal pumps, also driven by a vertical-shaft motor on the main floor, to the top of the boiler room, where the water will flow through Alberger-Hammond water meters into an open storage tank. This tank is divided

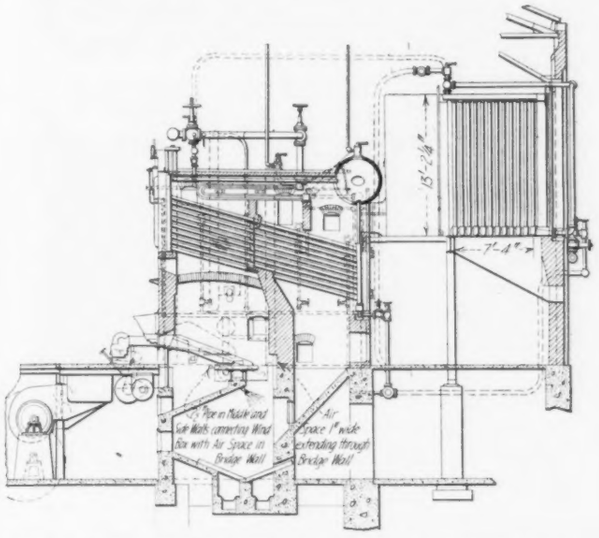

15'-2½"
7'-4"
Pipe in Mush and Set Walk cement to Wood Box with Air Space in Bridge Wall
Air Space 1" wide extending through Bridge Wall

FIG. 6—ECONOMIZERS ARRANGED TO BE ACCESSIBLE FROM OUTDOORS

into two compartments, one with a capacity of 6000 gal. (22,711 l.) for condensate and the other with a capacity of 3000 gal. (11,356 l.) for make-up water. The water from this storage tank will flow through a Hoppes open feed-water heater having two parts. The condensate passes over one-third of the heating surface and the make-up water over the remaining heating surface. From the heater the water will pass through a battery of four 400-gal. (1514-l.) per minute four-stage Cameron centrifugal boiler-feed pumps. Three of these pumps are motor-driven and one is steam-driven. The pumps will discharge into headers supplying the economizers, the economizers carrying full boiler pressure

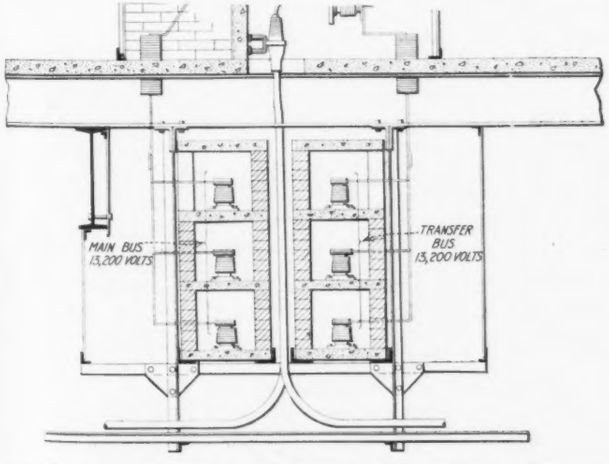


FIG. 7—BUS STRUCTURE SUSPENDED FROM CEILING GIRDER TO ECONOMIZE IN CONNECTIONS WITH EQUIPMENT ABOVE

plus the additional pressure required for forcing the water through the economizer to the boilers.

For purifying the make-up water for the boilers a lime and soda-ash plant is installed which consists principally of two 20,000-gal. (75,706-l.) wood-stave tanks with stirring mechanism and an elevated dosing tank. The river water is of fairly good quality except during high water. A battery of four 200-gal. (757-l.) per minute motor-driven centrifugal pumps is installed in the basement of the turbine room for furnishing water to the feed-water purification plant and for cooling the 15,000-kva. transformers in the yard.

THE ELECTRICAL SYSTEM

The main generators are connected to a 13,200-volt bus through General Electric Type H-3 oil switches. A transfer bus and a transfer switch are provided so that any 13,200-volt switch with its instrument transformers may be cut out of service and worked on when necessary without interrupting service. All feeders and other circuits are provided with the same type of oil switch, and all of them are remote-controlled from the switchboard.

The arrangement of the greater part of the electrical apparatus, which is placed outdoors, is shown on the plan of the station reproduced herewith. The outdoor oil switches for the 39,400-volt circuits are the General Electric KO-36 type, rated at 50,000 volts. They are mounted on pipe framework with the solenoid-operating mechanism and are equipped with three bushing-type transformers and inverse time-limit overload relays.

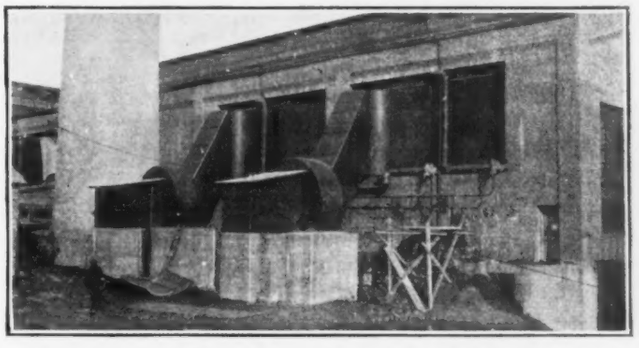


FIG. 8—INDUCED-DRAFT FANS OUTSIDE STATION

The bushings are interchangeable with those on the transformers and lightning arresters.

Two-tank aluminum lightning arresters are provided on 39,400-volt circuits and are equipped with sphere gaps, horn gaps and the other usual auxiliaries.

Energy for motor-driven auxiliaries will be supplied by two duplicate banks of three 300-kva., single-phase, 13,200/220 outdoor-type self-cooled Wagner transformers. The total load from motor-driven auxiliaries in the station will amount to 2533 hp.

The main turbo-generator, power transformers, turbo-exciter, the auxiliary motor drives aside from those mentioned, the control-battery charging set and oil drying and testing outfit were other pieces of equipment of General Electric make. The control battery is of the Exide (Electric Storage Battery) type.

In Columbus electrical energy will be received at 39,400 volts at one point for the present. Later the second and third receiving points will be provided. Energy will be distributed in the city between substations at 13,200 volts. The primary voltage for all light and power consumers is 4150 volts on a four-wire distribution system. The tie lines between the principal substations will operate at 13,200 volts and will consist of triple conductor lead-incased cables laid in vitrified clay-dust subways.

Selection of Motors Aided by Graphic Meters

These Instruments Also Facilitate Analysis of Machine-Tool Operations—Advantages and Disadvantages of Different Types—Value to Industrial Plants

BY C. E. CLEWELL

Assistant Professor of Electrical Engineering, University of Pennsylvania

The advantages of the graphic meter as an aid to the analysis of machine-tool operations is illustrated by a discussion of difficulties which have tended to retard the placing of motor application work on a scientific basis. Some of the possibilities in this direction through the use of graphic measuring instruments are outlined. Reference is made to various types of graphic meters, methods for making graphic records, and to certain results which may be looked for from their study.

THE selection of the proper size and type of motor for a given machine tool is often made difficult by the lack of information concerning the character of the load and the effective horsepower which corresponds to the successively changing horsepower requirements for the various parts of the duty cycle. An evidence of the many mistakes which have been made in the past in the selection of the motor is the extent of over-motored machines. By using motors which are higher-powered than necessary for driving machinery the initial investment for motors as well as the operating expense is unduly increased.

There are a number of items[1] involved in the application of motors which are of interest especially from the viewpoint of the central station. They include starting current and starting conditions of the motors, the power factor of the load, fluctuations of load, size of units, starting devices, type and voltage of motor and the hours of service. A very interesting case is cited by Wilson where motors used for the operation of refrigerating machines caused serious disturbances on the lighting system. Later the disturbances were found to be intensified on a certain step of the motor controller, so that ultimately special arrangements had to be made in the motor operation. This case is mentioned to show that the study of individual cases of motor-driven machines may be of added importance at times when the same feeder circuit which supplies the motors also supplies other central-station service such as lighting.

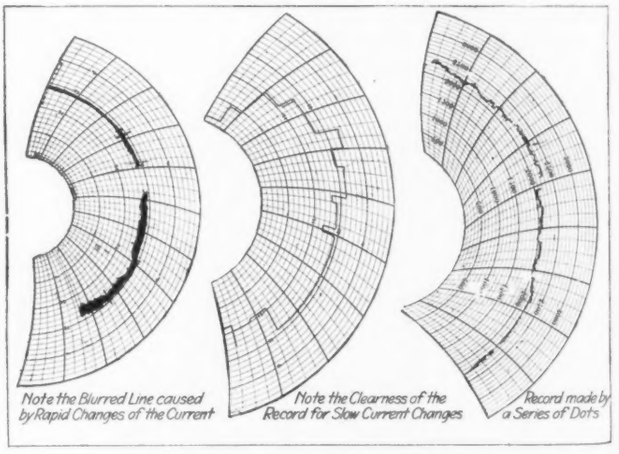
For a number of reasons, therefore, the analysis of factory operations becomes an item of considerable importance, and a graphic meter may be used to advantage for analyzing (a) the time required for various machinery operations, (b) the total or effective power required for the operation of given machine tools as well as the maximum peaks at certain points of the duty cycle, and (c) for obtaining such other information as may be desirable from the standpoint of central-station service.[2] The graphic meter lends itself particularly to the detection of time losses due to delays in chucking the work or to delays caused by neglect of work and to other causes, since by this instrument a detailed and permanent record is made in terms of time.

SOME AVAILABLE TYPES

The well-known circular-chart type of recording instrument furnishes a convenient basis for graphic records where the changes in the current or power to be measured are not so rapid that they make a blur in the record; in other words, where the changes are such that the recording needle can trace them clearly enough to permit analysis of conditions when desirable.

Owing to the relatively slow passage of the paper under the pen with the circular chart rapid changes in current, like those which made the record in Fig. 1, merely tend to produce a blurred band of ink which indicates little more than the extremes. This indication may often constitute all that is required, however, for such service as the charging of storage batteries. If the changes do not take place too rapidly, as in Fig. 2 for example, the circular chart is entirely suitable.

In the charts just referred to the record is produced by a continuous contact of the pen on the paper, which


Note the Blurred Line caused by Rapid Changes of the Current
Note the Clearness of the Record for Slow Current Changes
Record made by a Series of Dots

FIGS. 1, 2 AND 3—CIRCULAR-CHART RECORDS SHOWING EFFECT OF RAPID CHANGES IN CURRENT, THEIR SUITABILITY FOR INDICATING SLOW CHANGES, AND A CURVE IN WHICH PEN FRICTION IS REDUCED

results in friction that hinders the operation of the recording needle. To eliminate this factor the same general type of instrument has been designed, so that the pen is in contact with the paper only for an instant at a time, producing a dotted rather than a continuous line. A chart of this kind is shown in Fig. 3. In effect, the resulting record is a continuous line except where sudden changes occur. It is fairly obvious that these charts would have limitations in those cases where the performance of the machine tool under investigation placed demands on its motor which were of a rapidly changing character and in the analysis of which

[1] Based on a discussion by R. M. Wilson, *Transactions A. I. E. E.*, Vol. 34, p. 774.

[2] See section on "Measuring Instruments," "Handbook of Machine Shop Electricity," by C. E. Clewell, pp. 278 and 285. An additional reference is made to this source in the explanation of types.

the exact points of these changes and their duration become of the utmost importance.

For this class of analysis the continuous-roll graphic meter is well adapted because the speed of the paper can be made fast enough to record rapid fluctuations. Such a record is shown in Fig. 4.

Graphic meters are classified[2] under two heads, (a) those in which the chart or record is made directly by

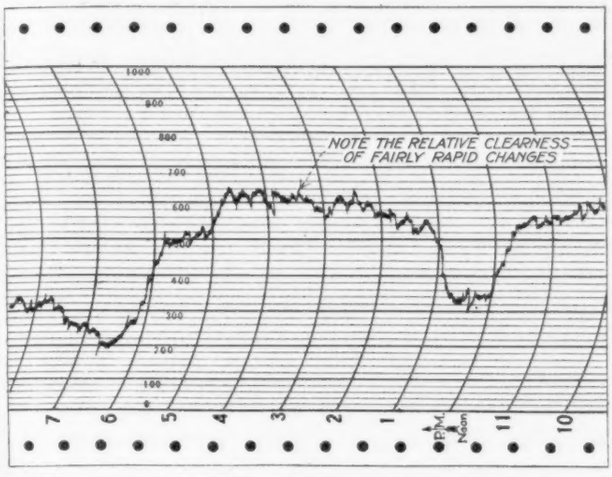


FIG. 4—CONTINUOUS-ROLL RECORD ADAPTED TO INDICATING RAPID FLUCTUATIONS

the moving element of the instrument, and (b) those where some separate form of mechanism is used for making the record. Class (a) includes graphic meters of such types as those of the Bristol, Esterline and General Electric companies, while the Westinghouse type is an example of class (b).

While graphic ammeters are adapted to direct-current circuits, the graphic wattmeter is to be preferred for measurements on alternating-current circuits. Little or no use is made of the graphic voltmeter for machine-tool analysis. It is desirable for graphic meters to have a fairly high paper speed for this service so that the changes in current or power may be recorded with a fair degree of clearness. In fact, it is considered desirable for graphic meters of this class to have several different paper speeds to take care of more or less rapid variations of the load to be measured. Moreover, a fairly high degree of accuracy of the instrument is recommended, since the record derived from it forms the basis of important conclusions. Finally, the paper on which the record is drawn should have a sufficiently wide scale for showing the extreme variations of the quantities under test.

Class (a) graphic meters (see classification referred to) of the direct-current types for current and voltage readings make use of a stationary-coil solenoid together with a movable element of soft iron in the form of an armature which acts against springs. The alternating-current meters operate on the electro-dynamometer principle; that is, with one coil stationary and one movable. The sensitivity of the instrument in this class is affected to a considerable extent by the friction of the pen on the paper.

Where high sensitivity is important several schemes are employed, one being the use of an intermittent-contact pen, mentioned before, and another the use of a pointer which traces a record on a smoked chart that is semi-transparent and which is "fixed" in a solution after the record is taken from the instrument, thus making a permanent record.

One type of graphic meter uses a separate relay device for the operation of the pen and its mechanism, which is thus entirely independent of the meter element. In this way the sensitivity of the meter is unaffected by the pen mechanism. The paper for this type is furnished with a scale 5¼ in. (13.3 cm.) wide, the co-ordinates being rectangular to facilitate analysis. Rolls 248 ft. (75.6 m.) long may be used, which, at a chart speed of 2 in. (5.1 cm.) per hour, permits two months' steady service.

In this particular meter the paper speed can be set at 2, 4 and 8 in. (5.1, 10.2 and 15.2 cm.) per hour, although speeds up to 4 in. (10.2 cm.) per minute are obtainable. The clock mechanism is self-winding in the standard form, although for low speeds a hand-wound type may be used. For high-speed paper operation the roll may be operated directly by the small motor which winds the clock.

PRACTICAL RESULTS OF LOAD ANALYSIS

The use of graphic meters of the types just described under actual operating conditions serves to show, (a) the way in which the motor-driven machine tool is being operated, (b) the presence of abnormal conditions in the machinery itself, (c) whether shafting losses are excessive, and (d), by a comparison with other charts from the same machines taken previously they show

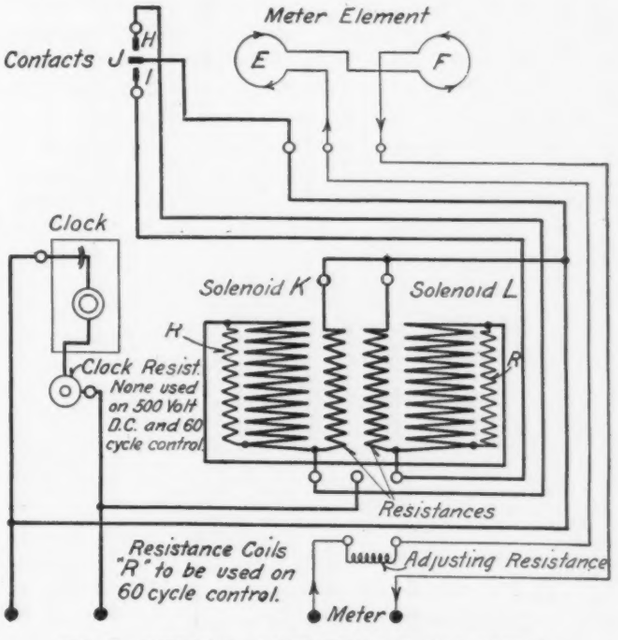


FIG. 5—INTERNAL CONNECTIONS OF ONE TYPE OF DIRECT-CURRENT GRAPHIC METER

whether production is being maintained at a proper rate.

In addition to these indications one of the principal uses in the standardization of machine-tool motor applications is the determination of actual rather than assumed horse-power requirements. This may be accomplished, of course, very readily in the case of machines which are already motor-driven but in the operation

[2] This classification is based on the "Standard Handbook for Electrical Engineers," fourth edition, p. 171, to which several references are made in this article.

of which there is some doubt as to the correctness of the motor size and type. In the case of line-shaft driven tools for which motor drive is considered a motor may be temporarily connected to the given machine and a graphic record made of its input for establishing the power requirements of the machine tool. In effect, this scheme makes use of the preliminary motor

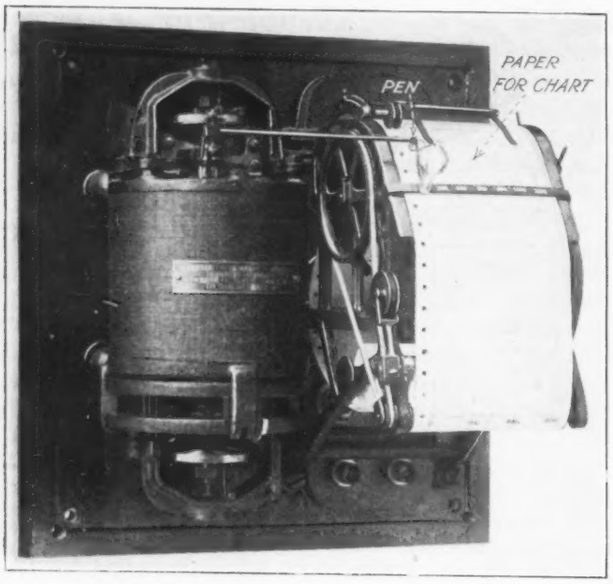


FIG. 6—POLYPHASE CURVE-DRAWING WATTMETER WITH REROLL ATTACHMENT

as a dynamometer, and the simplicity of this power analysis, in comparison with efforts to make a similar analysis by purely mechanical means, is apparent.

The idea of making fairly complete industrial "electrical surveys" with portable graphic instruments is not new, although its adoption is limited perhaps by a lack of a general appreciation of the advantages of such a course in present-day factories. Such surveys refer to more or less systematic tests of motor-driven machinery for the purpose of making regular checks of the load on given motors in terms of their capacity and for finding abnormal conditions which should receive the attention of the maintenance department.

The convenience and relatively high accuracy of the portable line of graphic meters are certainly important features in the modern types and in themselves commend a wider use of such instruments to the attention of industrial managers. Another advantage of portable meters is their reliability. Chart speeds are easily obtainable for a range from 0.75 in. (1.91 cm.) per hour to 6 in. (15.2 cm.) per minute, with nine values.[4]

Although the actual uses of the graphic meter are very numerous, several applications and practical results will illustrate the field. Thus, in the determination of the power required for elevator operation[4] a graphic wattmeter may be used to secure a record of watts and time. The resulting curve possesses an area which may be reduced quickly to kilowatt-hours. This value of kilowatt-hours, when taken in conjunction with the distance traversed, gives a basis for finding the kilowatt-hours per car mile.

A graphic meter applied to the motor of a motor-driven lathe gives a chart which may be used for finding the root-mean-square horsepower of the motor required for the work, as explained in a previous article.

In one case graphic meter records in a shop indicated an idle period for one or two hours each morning for most of the employees. As a result of these records, a study of the situation showed that the inability of the machine-tool operators to get the help of a crane for lifting the material into the machines was the cause of the delay. Additional helpers and better crane service removed the difficulty. Here the important point to note is that a major defect in the shop management was brought to light by the graphic records taken on the electric power circuits.

In another case where steel mill operations were involved the application of a curve drawing instrument, together with the knowledge on the part of the operatives that such an instrument was in use, improved production by nearly 20 per cent. The fact that a record is being made of the work, with a corresponding sense that good work will be noted as well as neglect, seems to stimulate the workmen to improved effort.

Other Devices

To emphasize the importance of the field of usefulness of the graphic meter for industrial operations, attention is directed to a paper[5] which discusses the extreme value of the multi-recording instrument[6] in various branches of electrical work. This instrument differs from the ordinary curve-drawing meter in that the continuous recording paper or tape moves only when a record is made, and a number of different quantities are charted on a single record.

This instrument has been proposed as of value in the recording automatically of the times and extent of the various steps in industrial processes, possibly by the

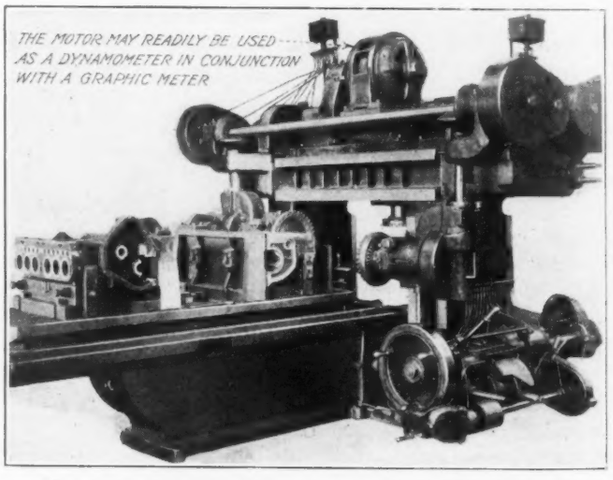


FIG. 7—THE MOTOR DRIVING THIS MACHINE MAY BE USED AS A DYNAMOMETER WITH A GRAPHIC METER

mere electrical contact made at the start and stop of an operation and transcribed on such a chart at some central location.

BIBLIOGRAPHY.—*American Machinist*, Vol. 41, No. 20, p. 855; *Electric Journal*, Vol. 14, No. 2, p. 59; bulletins of the Esterline and Bristol companies, together with the various references made in the footnotes throughout the text.

[4]See "Standard Handbook for Electrical Engineers" fourth edition, p. 1226.

[5]By Charles P. Steinmetz. *Transactions A. I. E. E.*, Vol. 33, p. 283, and discussed by C. L. Clarke in the same volume.

[6]Described by E. E. F. Creighton, *Transactions A. I. E. E.*, Vol. 31, p. 825.

Adapting Induction Meters to New Frequency

How a Company Changed Its Sixty-Cycle Watt-Hour Metering Equipment So as to Operate on Twenty-five-Cycle Energy and Later Changed Back to Sixty-Cycle at Minimum Expense

BY E. L. FISCHER

SOME time ago an electric utility with which the writer was connected found it expedient to change the frequency of its electric-service supply from 60 cycles to 25 cycles. Two years later it became necessary to revert to former conditions. Among other problems, the question arose of what to do with the meters. At first it was thought necessary to dispose of the 60-cycle meters and purchase 25-cycle instruments. By co-operating with the instrument manufacturers and conducting some investigations, however, a scheme was worked out whereby the old meters could be used under the changed conditions without sacrificing meter accuracy or efficiency.

Theoretical Analysis of Conditions

Owing to limited space, it is necessary to assume that the reader is familiar with the operating principles of induction watt-hour meters. To understand the principles on which the changes were made, assume a meter with a shunt coil of zero resistance; that is, one whose impedance is composed entirely of inductive reactance. In such a meter it is at once clear that the current taken by the shunt coil would be 90 deg. behind the impressed voltage, and consequently no "lag" would be required. Now consider that this meter is designed for a frequency f and that it is in a circuit on a system with a frequency n times that for which the meter was designed, or nf.

The torque produced on the disk by the windings of a meter is determined by (1) magnitude of the series and shunt coil flux, (2) phase relation of series and shunt coil flux, (3) frequency of the flux, and (4) resistance of current paths in the rotor or disk. The torque is directly proportional to the first, third and fourth and varies as the sine of the angle between the shunt and series coil flux. The fourth is, of course, unaffected by frequency variation and so will be considered no further.

In placing the meter on a frequency nf the first effect will be, of course, a change in frequency of flux, and from this cause the torque (all other conditions remaining the same) will be n times its former value. The magnitude and phase of the series-coil flux which is caused by the load current would not be affected by a change in frequency. Since reactance varies directly with the frequency, its value under the new condition will be n times the original value; hence the current through the shunt coil will be $1/n$ original value, and so will the shunt-coil flux. The phase relation of the flux to the impressed voltage is unchanged; therefore the torque would be $1/n$ former value, all other things remaining the same. Owing to the difference in frequency, however, it is n times its former value; consequently the resulting torque for a given load and power factor remains unchanged regardless of frequency variation and the meter would be correct on all loads and frequencies.

To an actual meter the above discussion applies so far as flux frequency and series-coil flux magnitude and phase relation are concerned; but, since the shunt coil has resistance as well as reactance, the assumption that the shunt coil is purely reactive with resulting conclusions does not apply. The impedance of the shunt coil varies with the frequency by an amount depending upon the ratio of inductance to resistance. The reactance varies directly with the frequency; the resistance remains unchanged. If this ratio of inductance to resistance be large, the change in impedance will be correspondingly large, and vice versa. It is not possible, unless some specific case be taken up with known or assumed values of resistance and inductance, to determine the exact effect frequency variation has upon the accuracy of induction meters. However, there are certain results which can be foreseen.

It is plain that, since the ratio of resistance to reactance varies, the phase relation between impressed voltage and shunt-coil flux will be greatly affected, and to get anything like successful operation from the meter at the new frequency it will have to be "re-lagged." Also, it is plain that the shunt-coil current will be considerably altered since the impedance is affected. If the frequency be lowered to any great extent, the current will become excessive and heat the coil dangerously, while if the frequency be raised the current is decreased and consequently the shunt coil losses will be decreased.

It is reasonable, therefore, to expect that a meter may be operated successfully on any frequency, within reason, greater than rated frequency by simply recalibrating. It is equally clear that a meter cannot be operated on frequencies much lower than rated because of the excessive current taken by the shunt coil and by the difficulty of getting sufficient lag adjustment. There is every reason to expect then that a meter designed for 25-cycle circuits could be made to operate successfully on 40 cycles or 60 cycles, or even 133 cycles, but a 60-cycle meter could hardly be expected to operate satisfactorily at rated voltage on 25 cycles. The registration of a meter which has a shunt coil in which the ratio of inductance to resistance is very large will be practically unaffected by frequency variations.

Results of Actual Experience

The results of the author's experience in actual work during the changes previously referred to have substantiated the foregoing conclusions to a marked degree. In changing from 60-cycle to 25-cycle circuits we did not find it possible to operate our 60-cycle meters on 25-cycle lines without changes in the meter coils; but in the second change we found, as expected, that we could operate the 25-cycle meters very satisfactorily on 60 cycles by only recalibrating.

Following is a detailed list of just what was done

with each type of meter in the company's service:

General Electric, type I, 25-cycle meter, to operate on rated voltage and loads 60-cycle: Remove the copper bands from the shunt pole, change the heavy-light load adjustment plate for that of a regular 60-cycle meter and recalibrate on 60 cycles, using 25-cycle meter constant. (Note—The speed of a 25-cycle type-I meter is just half that of the 60-cycle meter of same capacity.)

General Electric, type I, 60-cycle meter, to operate on rated voltage and loads 25-cycle: Exchange the 60-cycle shunt and lag coils for regular 25-cycle coils, using the same series coils and laminated sheet-steel structure (if preferred, the entire laminated structure with all coils attached may be exchanged, but this is not necessary); also exchange the register for the register of a regular 25-cycle meter of the correct capacity (this is necessary on account of the change in speeds as noted above) and calibrate on 25-cycle, using standard 25-cycle meter constant.

General Electric, type I-10, 25-cycle on 60-cycle circuit rated voltage and loads: Exchange the heavy copper lag plate and the heavy-light load adjustment plates for the regular 60-cycle plates and recalibrate meter on 60 cycles, using 25-cycle constant.

General Electric, type I-10, 60-cycle on 25-cycle circuit rated voltage and loads: Exchange the entire laminated structure with all coils for the regular 25-cycle structure and coils. Exchange 60-cycle lag and light-load adjustment plates for regular 25-cycle plates. Exchange 60-cycle permanent magnet for 25-cycle magnet; also exchange register as the speed is different. Calibrate on 25 cycles, using constant of regular 25-cycle meter.

General Electric, type I-14, 25-cycle on 60-cycle circuit rated voltage and loads: Remove heavy copper plate attached to laminated structure surrounding shunt pole and calibrate on 60 cycles.

General Electric, type I-14, 60-cycle on 25-cycle circuit rated voltage and loads: Exchange entire laminated structure and coils for regular 25-cycle structure and coils. Also exchange permanent magnet and calibrate for 25 cycles.

Westinghouse, type OA, 25-cycle on 60-cycle rated voltage and loads: Remove the copper bands surrounding the shunt pole and calibrate on 60 cycles.

Westinghouse, type OA, 60-cycle on 25-cycle circuit. This meter cannot be supplied with 25-cycle coils on account of difference in size. It is necessary to supply cases for these, and we found it to our advantage to sell these meters at second-hand values and replace them with regular 25-cycle meters.

Westinghouse, type C, 25-cycle on 60-cycle circuit rated voltage and loads: Remove the copper bands from the shunt pole and calibrate on 60-cycle.

Westinghouse, type C, 60-cycle on 25-cycle circuit rated voltage and loads: Exchange the entire laminated structure with all coils for regular 25-cycle structure and coils; also exchange permanent magnet and calibrate on 25-cycle.

Sangamo, type H, 25-cycle on 60-cycle circuit rated voltage and loads: Break the brass band surrounding the shunt pole and calibrate on 60-cycle, using 25-cycle constant.

Sangamo, type H, 60-cycle on 25-cycle circuit rated voltage and loads: Exchange the shunt and lag coils with their laminated structure for regular 25-cycle coils and structure; also exchange permanent magnet and register gear train attachment and calibrate on 25-cycle, using regular 25-cycle constant. (In the later type H meters it will be found that the laminated structure is of the same dimensions in both 25-cycle and 60-cycle meters, so that the series structure of the 60-cycle meter will fit on the shunt structure of the 25-cycle meter, making it unnecessary to exchange the series-coil structure. In the meters of older type, however, this is not true, and the entire laminated structure would have to be exchanged; also new holes would have to be drilled and tapped in the case, as the supporting lugs of the 25-cycle structure would not fit the holes in the regular 60-cycle case.)

In all of the foregoing changes it should be considered that the word "calibrate" includes the proper lagging of the meter as well as the correct adjustment at full and light loads and unity power factor.

In making the change from 60 cycles to 25 cycles the cost varied somewhat in different types of meters, owing to different costs of coils, etc. The average cost for materials was roughly $1.75 per meter, and the labor cost, including installation and removal, cartage to and from the shop, and actual labor in the shop, was 60 cents, thus making the total cost per meter $2.35. This cost is net after deducting for the salvage value of coils, etc.

The second change was not nearly so expensive, practically the entire cost being labor. This item, including installation, etc., as above, was roughly 55 cents per meter.

After making the changes both ways on all meters, it was found that the 60-cycle meters changed to 25-cycle meters are in every case practically identical in operation with meters of the same type designed for 25-cycle service; that the 25-cycle meters operated on 60-cycle are not identical with meters designed for 60-cycle service, as there is in all makes of meters a considerable difference in torque between 25-cycle and 60-cycle meters. It was found, however, that the 25-cycle meters operated on 60-cycle circuits (after the changes listed above) had practically the same torque, maintained accuracy, etc., as they formerly had on 25-cycle circuits, and that the losses were in the neighborhood of 40 per cent of their original value. The company is well satisfied with the results of the change and believes its meters will give entire satisfaction throughout their life.

Electrical Restrictions at Rome

New regulations controlling the use of electricity for lighting and heating have been issued by Rome municipal authorities. Exits of theaters, concert halls, etc., will be allowed only one lamp, not exceeding 60 watts. Present lighting of shop windows and showcases is to be reduced 50 per cent, by discontinuing half of the lamps in use and keeping the candlepower of the remaining half at present value. No further extensions will be permitted, either by changing the candlepower of the lamps or otherwise, in heating and lighting installations of shops, offices, public buildings, etc. Use of energy for heating is forbidden between 4 p. m. and 10 p. m.

Cinders for Fuel in Germany

According to the *Frankfürter Zeitung*, the new power house of the Frankfort State railway station at Frankfort-on-the-Main is utilizing for the first time in the history of German railroading cinders collected by locomotives in special "cinder catchers." When locomotives are cleaned at the end of a trip the cinders are piled on a large heap, from which an electric cable car runs directly to the boiler room. Cinders are fed to grates by automatic underfeed stokers, and the combustion is so complete that less than 0.5 per cent of combustible material is found in the ashes. Three boilers of 250 sq. m. heating surface each supply steam to two turbines of 2000 hp. each, while a third turbine of like rating is to be installed later on foundations already prepared. Energy is generated at 6600 volts, in sufficient quantity to supply light and power demands. This economy is a result of the coal situation.

Initial Current Obtained in Incandescent Lamps

Results of Investigations to Determine the Amount of "Overshooting" of the Current When Metal-Filament Lamps Are Thrown in Circuit— The Three Main Factors

BY C. J. BERRY

Engineering Department National Lamp Works of General Electric Company

The initial current does not rise to a value greater than normal strength in the proportion of the hot to the cold tungsten lamp resistance. Line resistance and reactance drops, and also the behavior of the electrical apparatus supplying the energy, are factors which decrease the effective voltage at the lamp, thereby keeping the current from rising to a high degree. The higher-wattage lamps do not "overshoot" to so high a percentage above normal value as the lower-wattage lamps. The total time required for the current to rise initially and then to settle at approximately a constant value is from 0.1 second to 0.2 second, depending upon the size of the lamp.

There is a marked initial distortion of the current wave form on alternating current that is due to the alternate cooling and heating of the filament. The initial current rises to different percentages, depending upon the point of the voltage wave at which the lamp is thrown in circuit and also upon the condition of the magnetism of the transformer before the switch is closed.

The "overshooting" occurring with vacuum-type lamps is slightly less than that taking place with gas-filled lamps, since the filament temperature of the gas-filled lamp is higher than the operating filament temperature of vacuum lamps.

There is no excuse for fuses blowing or circuit breakers opening when gas-filled lamps are thrown on circuit, provided that the protective apparatus is of proper rating and set correctly, and has a small time-factor element.

WHEN tungsten-filament lamps are first thrown in circuit there is an initial rush or "overshooting" of current caused by the filament resistance of the cold lamp being low as compared to the resistance it has when the lamp is lighted. It is the purpose of this article to show how much this initial current is with different lamps and how long this current exists at the high value. The determination of the initial rise of current or "overshooting," and also the action of the voltage at the lamp at the same time, involves some knowledge of the effect of the line constants. With a rapidly changing current like the initial current of the metal-filament lamps inductance effects have to be taken into account. The main factors influencing the initial phenomena are lamp-filament resistance, line resistance and reactance, and the regulation of the source of supply. These factors will be considered separately in the following paragraphs.

LAMP-FILAMENT RESISTANCE

The resistance of the filament of a tungsten lamp is many times greater when the lamp is lighted than when the lamp is not connected in the circuit; that is, the temperature coefficient of the filament is positive. With the old type of untreated carbon-filament lamps the resistance of the filament decreases as the filament temperature increases.

The lamps used in this work were the gas-filled tungsten lamps, vacuum tungsten lamps and untreated carbon-filament lamps. The lamps were of the 105-125 volt class. All of the differently sized gas-filled lamps between 75-watt and 1000-watt rating were included. Different sources of energy were used for supplying the energy to the lamps; namely, a 7.5-kw., 120-volt direct-current generator, an 80-amp.-hr., 120-volt storage battery, and a 115-volt, 60-cycle lighting circuit. These different sources of supply were used in order to note any difference in the initial behavior of the current.

Neglecting reactance effects and assuming the voltage across the lamp terminals to remain the same, the current which would flow when the lamp was first put on the circuit would vary inversely as the filament resistance. The initial current theoretically then would be the normal current value times the ratio of the hot resistance to the cold resistance of the filament.

LINE RESISTANCE AND REACTANCE

The initial current under constant voltage conditions at the lamp would be as many times greater than the normal current as the ratio of hot to cold resistance. However, the voltage does not remain constant, because there are self-induction effects occurring on the line and there is an increased resistance drop taking place in the line. Also the regulation of the electrical apparatus furnishing the energy must be considered. Some of the instantaneous effects occurring in the lamp during this initial phenomenon are inductance, skin effect and the cooling of the filament by the gas and leading-in wires, but these effects are probably of very small account. The line from the generator to the lamp was approximately 150 ft. (45.7 m.) long and the wire was No. 8 B. & S. gage copper wire, making the total line resistance approximately 0.2 ohm.

The voltage across the lamp is less than normal line voltage by an amount equal to the sum of the increased resistance drops and reactance drops in the circuit. As the current increases, however, the slope of the current curve becomes less steep, making the successive inductive drops smaller and thereby affording the line voltage a chance to recover. On the other hand, as the current rises the resistance drops in the circuit increase, but this is not large enough to keep the voltage across the lamp from rising to its normal operating potential. The current keeps on rising for only a small interval of time, however, and then it decreases, since the lamp filament is becoming hot very rapidly. As the current increases the lamp-filament resistance increases rapidly until there is finally a point reached beyond which the current does not increase. This maximum point occurs when the lamp resistance begins to increase more rapidly than the voltage across the lamp and is determined by subtracting the resistance and reactance drops in the circuit from the generator emf. This maximum current value is reached in a very short interval of time, varying from 4×10^{-4} to 3×10^{-3} second. The current after reaching its maximum value immediately starts to resume its normal operating value, and this is reached

in about 0.1 second to 0.2 second, as shown by the oscillograms.

VOLTAGE REGULATION AND LINE REACTANCE

The machine used in the tests was a 7.5-kw. direct-current generator. With a machine of this rating it hardly seems probable that the machine regulation would have much effect on any initial voltage regulation. If the generator were small, a poor instantaneous regulation would be expected. Armature reaction and reactance effects as well as armature resistance will produce a voltage change. As soon as the lamp is switched in circuit, the voltage at the generator will drop slightly, since there is this initial "overshoot" of current to the lamp. If a small generator were supplying the energy to the lamps, it could not be expected that the initial rise of current would be so great as if the generator used were sufficiently large to absorb the load without showing a decrease in voltage.

To learn something about the inductive reactance of

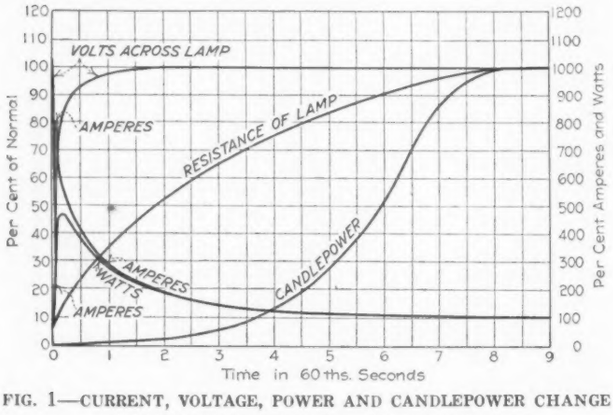


FIG. 1—CURRENT, VOLTAGE, POWER AND CANDLEPOWER CHANGE AFTER LAMP IS CONNECTED WITH CIRCUIT

the particular circuit used in these tests, a non-inductive resistance was connected in the line in place of the lamp and the current switched on. In this test an 11-kw. generator was used, because at that time it was impossible to get the 7.5-kw. exciter. An immediate fall in open-circuit voltage on the line, followed by a gradual rise in voltage and current, was noticed on the oscillogram. In this case the voltage and current came to their normal value in phase with each other and reached maximum values at the same time.

The initial drop in voltage can be accounted for by several different actions; namely, generator resistance, reactance and reaction, and line resistance and reactance. It is safe to assume that the circuit resistance remains constant, and hence, neglecting the circuit reactance, the voltage on open circuit should immediately come to its normal value, and the same is true of the current. There is, however, an inductive reactance effect in the circuit which causes the voltage to fall to a low value, from which it gradually resumes its normal value. This inductive reactance effect can be attributed mostly to the line reactance and not to any generator action.

Since the wires for this line were each about 150 ft. (45.7 m.) in length and were run in conduit, the coefficient of self-induction is comparatively small. However, the rate of change of the current with respect to time is great and produces a large back emf. Most lines in practice have a larger coefficient of self-induction and

TABLE I—RATIO OF HOT TO COLD FILAMENT RESISTANCE OF INCANDESCENT LAMPS

Lamp	Ratio of Hot to Cold Resistance (Approximate Only)
Carbon, untreated	0.5 to 1
Metallized filament	1.5 to 1
Tantalum	6.5 to 1
Vacuum-type tungsten filament	11.5 to 1
Gas-filled tungsten filament (75-1000 watts)	14.6 to 1*

*The resistances on which the ratio is based include the resistance of the leading-in wires as well as that of the tungsten filament, but the resistance of the leading-in wires from the lamp base to the filament is only a very small percentage of the total lamp resistance. The increase in the ratio of hot to cold filament resistance of the gas-filled lamps over that for the vacuum lamps is due to the higher operating filament temperature of the gas-filled lamps.

TABLE II—RATIO OF INITIAL MAXIMUM CURRENT TO NORMAL CURRENT

Lamp Wattage	Ratio of Initial Maximum Current to Normal Current	Ratio of Initial Effective to Normal Current
75	12	....
100	11	1.5
200	10	....
300	10	....
400	10	....
500	9	1.9
750	8	....
1000	7	2.5

TABLE III—TIME FOR CURRENT TO REACH MAXIMUM AND CONSTANT VALUES†

Lamp Wattage	Time to Reach Maximum Values, Sec.	Time for Approximate Normal Current, Sec.	Time When Double Normal Current Is Reached. (Descending Side of Current Curve), Sec.
75	0.0004	0.07	0.01
100	0.0007	0.10	0.02
200	0.0008	0.10	0.03
300	0.0011	0.13	0.03
400	0.0012	0.13	0.03
500	0.0014	0.15	0.03
750	0.0021	0.17	0.04
1000	0.0031	0.23	0.07

†If the lamp filament happens to be warm, the current does not rise to such a high maximum value.

TABLE IV—DECREASE IN OPEN-CIRCUIT VOLTAGE INITIALLY WHEN LAMP IS THROWN IN CIRCUIT

Gas-Filled Tungsten Lamp (Watts)	Maximum Current (Amp.)	Line-Resistance Drop with Maximum Current (Calculated), Volts	Decrease in Open Circuit Voltage Initially (from Oscillograms), Volts
75	7.2	1.4	29.9
100	9.0	1.8	35.1
200	17.2	3.4	42.5
300	26.2	5.2	61.4
400	36.6	7.3	61.7
500	45.7	9.1	71.6
750	51.7	10.3	86.0
1000	65.2	13.0	92.6

tend to prevent the current from rising very high initially.

Although the ratio of the hot to cold resistance for gas-filled lamps is 14.6, it may be noted that on none of the oscillograms did the initial current rise to 14.6 times the normal current value. The nearest approach to this was twelve times and occurred with the 75-watt lamps. There is a decrease in the ratio of initial maximum to normal current as the size of the lamps increases. With the low initial resistance of the lamp filament, the current builds up at a very rapid rate, and this produces a reactance drop in the line which, added to the increased initial resistance drop in the line, brings the effective voltage at the lamp to a low value for some of the higher-wattage lamps.

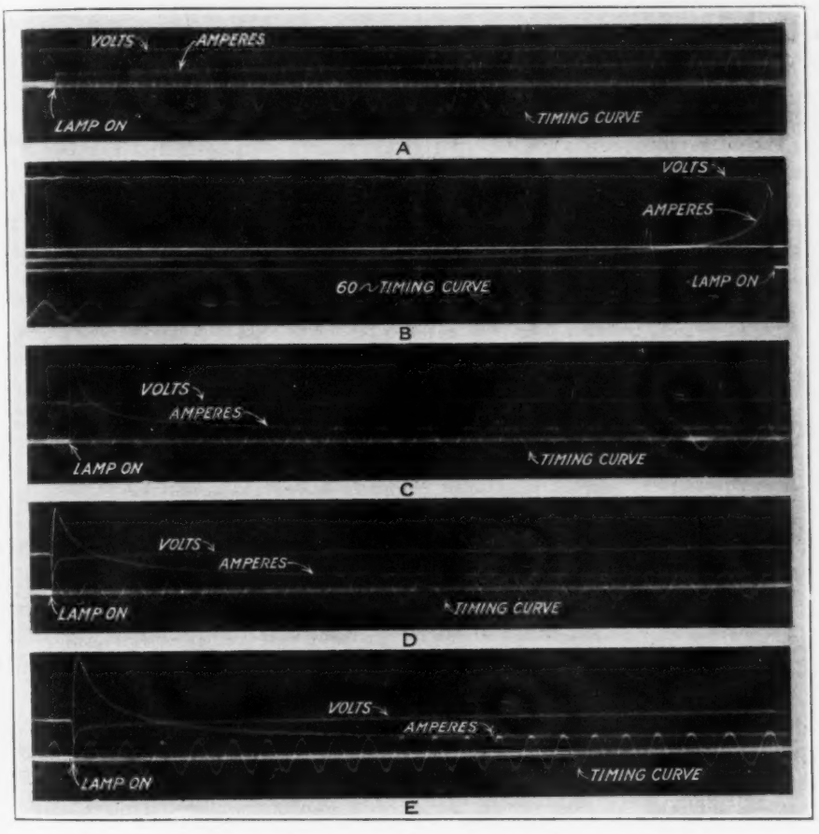


FIG. 2—VARIATIONS IN CURRENT WHEN INCANDESCENT LAMPS ARE ENERGIZED

A—112-volt, 120-watt carbon lamp; B—115-volt, 300-watt gas-filled lamp; C—119-volt, 400-watt gas-filled lamp; D—118-volt, 750-watt gas-filled lamp; E—117-volt, 1000-watt gas-filled lamp. The source of supply was a 7.5-kw. direct-current generator, the timing curve having a frequency of 60 cycles

It may be noted that the decrease in voltage read from the oscillograms is very much greater than the calculated line resistance drop due to the maximum current flowing. Since this large drop in voltage across the lamp cannot be all accounted for by a line resistance drop, it must be caused either by a large inductive reactance voltage drop on the line or the regulative action of the electrical apparatus supplying the energy.

The decreases in voltage from open-circuit values expressed in percentage terms range from 27 per cent to 78 per cent of open-circuit voltage. The decrease in voltage in every case as shown on the oscillograms is many times greater than that which could be accounted for by a line-resistance drop alone. Of course, the machine regulation has some effect on this drop in voltage, but since the full load current that this machine delivers is approximately 65 amp. it does not seem probable that the generator would show a very marked decrease in terminal voltage, or, in other words, a bad instantaneous regulation.

The initial drop in voltage when a lamp is put on circuit was noticed also when the storage battery supplied the energy instead of the direct-current generator. In fact, the voltage recovery was less rapid in the case of the storage battery. This was evidently due to the change in internal resistance of the battery and perhaps to a time lag of action of the battery.

The current rises to a maximum value in a very short interval of time, approximately from 0.0004 second to 0.003 second, and hence there is a large change in the linkages between the flux and the circuit. This initial back electromotive force of self-induction must be the main cause of the excessive initial voltage drop across the lamp.

Complicated relations take place during this initial phenomenon, and if any mathematical demonstration were applied it would necessitate a knowledge of the constants of the entire circuit and it would also have to take into account the variable voltage at the lamp due to the line reactance, the generator regulation, the variable circuit resistance drop and the change in resistance of the filament with a rapid change in current which would require some knowledge of the thermal capacity or the lag of temperature with instantaneous current. Also with the rapid change in current skin effect in the filament of the lamp would probably have to be taken into account, as well as the heat conduction and convection by the gases in the lamp bulb from the tungsten filament and also the cooling effect of the leading-in wires.

In this article it will be sufficient to state, however, that the current does not "overshoot" in the ratio of the hot to cold resistance. The larger the lamp, the less will the current "overshoot" when expressed in percentage terms. The current with the 75-watt lamp went to 1200 per cent of normal current, while with the 1000-watt lamp it rose to only 700 per cent of normal current. There is some inherent regulation in all circuits which prevents the current from rising to the theoretical 1460 per cent of the normal current value.

ACTION ON ALTERNATING CURRENT

Some oscillograms were taken on throwing a 1000-watt gas-filled tungsten lamp in circuit, using 60-cycle alternating current. Experiments were performed to determine the effect of switching on the lamp at the zero point and also at the peak of the voltage wave. The oscillograms showed that the time needed for the alternating current to assume a normal value was identical with that required for the direct current to reach its normal value. One might expect, however, that with

the alternations in current there would be some cooling action on the filament and that more time would be required for the current to assume a normal operating value. The amount of "overshooting" of the current when the 1000-watt gas-filled lamp was thrown in circuit at the peak of the voltage wave was 600 per cent and when thrown in at the zero part of the wave was only 500 per cent. On direct current with this lamp the initial "overshooting" was found to be about 700 per cent.

The current wave form was not a sine curve like the voltage wave form. Some distorting action seems to have taken place. There was an apparent lead of the peak of the current wave with respect to the peak of the voltage wave. The current wave shape was rather steep at first, rising to a peak and then falling off more gradually. This was caused by the change in resistance of the lamp filament. When the current starts from zero up to its maximum value, the filament is at the cooler state and proceeds to the hotter state, producing an "overshooting" effect. When the voltage decreases the current does not assume so great a value as it had at the same voltage point on the increasing side of the voltage wave. In other words, considering two equal voltage values, one on one side of the voltage wave and one on the other side, there is a greater current at the first voltage point than at the second, because the filament is cooler in the first instance than in the second. The current starts to return to zero before the voltage reaches its maximum point, because the rate of change of the resistance is greater than the change of voltage. Assuming constant voltage points on both sides of the voltage wave, on the upward portion of this wave the filament resistance is low, but on the downward portion it is greater, hence less current will flow in the second case. This causes a distortion of the current wave. Since the current reaches its maximum value before the voltage peak, the maximum overshooting occurs when the lamp is thrown in circuit just before the voltage wave reaches its peak value.

The maximum value of the initial current depends somewhat upon the condition of magnetism of the transformer before the switch is closed, and this magnetic condition depends upon the point in the current cycle at which the transformer was opened when last used.

Action with Vacuum-Type Tungsten Filament

Theoretically the "overshooting" of the initial current when vacuum-type tungsten-filament lamps are thrown in circuit would not be so great as that taking place with gas-filled lamps. The ratio of the hot to cold resistance of the vacuum lamps is not so large as that for the gas-filled lamps, and also the cooling effect of the gas in the gas-filled lamps keeps the filament cold longer, giving the current an opportunity to rise. This difference is small and could hardly be distinguished by oscillograms.

Some tests were made using potentiometers for reading the voltage and current to determine with a higher degree of accuracy how long it took for the current to attain a constant value with gas-filled lamps. The results show that the time required for the current to reach a constant value when gas-filled lamps are switched in circuit varies from one-half minute to two minutes for the 100-watt to 1000-watt lamps, inclusive.

There is absolutely no cause for any blowing of fuses or the opening of circuit breakers when a lamp load is first thrown on the circuit, provided that the fuses are of the correct size for the load and the breakers are set properly. The effective current during the brief period of 0.1 second to 0.2 second is only approximately 100 per cent greater than normal. With this overload the ordinary fuse or circuit breakers will not open the circuit because of the time element involved in their operation.

Switching on Lamp Bank on Service Lines

In actual practice more than one lamp is, as a rule, thrown on circuit at the same time. The effect is practically the same as switching on one lamp having a wattage rating equal to the sum of the individual wattages of all the lamps put on circuit. If the lamps were not grouped together or concentrated on the line, there would be perhaps a slight difference in the effect produced by switching on a number of lamps or one lamp of the combined wattage, owing to a difference in the current strength at various parts of the multiple line, since there is more current flowing in the line at the supply end. This produces a variation in the reactance and resistance drops in the line, and the initial rush of current at the supply point would be slightly different in the two cases.

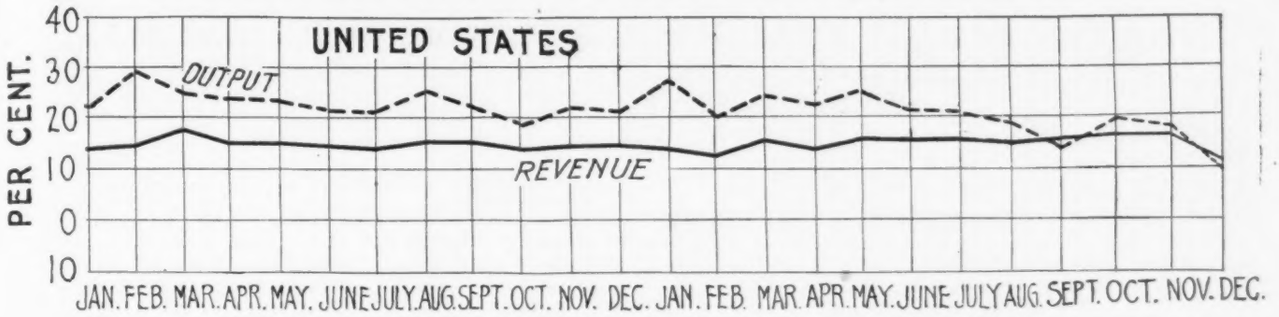
Where an installation of vacuum-type tungsten-filament lamps is replaced by one of gas-filled lamps there will be only a very slight difference in the amount of "overshooting" if the total wattage in each case remains the same, although the current in the gas-filled lamp installation will reach a slightly higher value because of the greater difference existing between the cold and hot resistance.

It must be borne in mind that the results of this test are those obtained when using a certain supply source and electric circuit. Slightly different results might be realized under different circuit conditions. The usual circuit would be found to have a greater line reactance, and this means that the initial rise in current would not be as high as the results of this test show.

German Central-Station Rates

A recent communication from the Electricity Administration of Germany discusses grounds upon which central stations are entitled to increase charges, says the London *Electrical Review*. The price of coal has risen 100 per cent or more, that of other working materials several hundred per cent and wages have risen to an extraordinary level. Voluntary allowances to dependents of workmen represent a further heavy burden. Bulk consumers are therefore urged to pay a higher price in proportion to the increased cost, even where long-term contracts give them a legal right to supply at pre-war prices. Other results are being felt from the introduction of "summer time," restricted use of light and power on grounds of economy or because of small works being closed, and absence on active service of innumerable small consumers. It is pointed out that the effective maintenance (financial and material) of electricity and gas works is a matter of national importance, also that these concerns are at present subject to abnormal depreciation as well as increased working costs.

Central-Station December Operations



CENTRAL-STATION INCOME AND OUTPUT GAIN IN PER CENT BY MONTHS FOR NATION

THE effect of coal shortage and the readjustment of business on account of the war are beginning to show in the returns made by electric utilities to the ELECTRICAL WORLD. Reports of the central stations for December, 1917, indicate an increase of 11.5 per cent in revenue from the sale of energy and of 9.6 per cent in the kilowatt-hour output as compared with December, 1916.

It was to have been expected that the December statistics would carry some reflection of the slow-down in industry which arose from the abnormal operating conditions. Shortage of coal supply was of course a large contributing factor. Another was the gradual but apparently sure reduction in activity of the less essential and non-essential industries. Still another was the aggravated state of affairs in even the industries vital to the prosecution of the war, where railroad embargoes and the general paralysis of transportation facilities, together with labor uncertainties, combined to reduce output of factories.

Though still making an increase in both gross revenue and kilowatt-hour output, the central stations were so affected by the unprecedented situation that their percentage of gain in both items was smaller than in any other month of the year. The gains, however, were good average increases, and it is only as they are compared with the stimulated output when there were no special handicaps to production that they look somewhat small. An increase of around 10 per cent covering all parts of the country is progress at a very fair rate.

Based on the returns shown for 55 per cent of the industry, the ELECTRICAL WORLD estimate for the whole industry in December is: Revenue, $44,450,000; output sold, 2,345,000,000 kw.-hr.

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE-MONTH PERIOD

Month	Percentage of Industry Represented	Revenue from the Sale of Energy			Kw.-Hr. Output		
		1917	1916	Per Cent Increase	1917	1916	Per Cent Increase
Jan.	63	27,408,000	23,969,000	14.4	1,495,829,000	1,180,884,000	26.7
Feb.	63	25,204,000	22,295,000	13.1	1,240,995,000	1,036,014,000	20.0
March	64	23,949,000	20,913,000	14.6	1,409,129,000	1,139,453,000	23.6
April	63	22,927,000	20,165,000	13.8	1,328,092,000	1,085,554,000	22.5
May	62	23,369,000	20,307,000	15.2	1,459,085,000	1,163,483,000	25.3
June	63	23,279,000	20,168,000	15.6	1,407,860,000	1,165,629,000	20.8
July	63	22,768,000	19,680,000	15.8	1,397,482,000	1,159,410,000	20.5
August	63	22,718,000	19,972,000	13.8	1,451,928,000	1,223,373,000	18.7
Sept.	63	23,861,000	20,896,000	14.3	1,376,370,000	1,219,117,000	13.0
Oct.	62	25,748,000	22,334,000	15.4	1,522,149,000	1,279,140,000	19.0
Nov.	62	26,665,000	23,183,000	17.0	1,485,370,000	1,292,113,000	15.1
Dec.	55	24,455,000	21,977,000	11.5	1,288,085,000	1,176,471,000	9.6

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

	Month	Percentage of Industry Represented	New England States			Percentage of Industry Represented	Atlantic States			Percentage of Industry Represented	Central States			Percentage of Industry Represented	Pacific and Mountain States		
			1917	1916	Per Cent Increase		1917	1916	Per Cent Increase		1917	1916	Per Cent Increase		1917	1916	Per Cent Increase
REVENUE	January	64	$3,181,000	$2,762,000	15.1	66	$11,400,000	$9,874,000	15.6	56	$8,081,000	$7,013,000	15.2	86	$4,602,000	$4,020,000	9.5
	February	64	3,039,000	2,686,000	13.1	65	10,249,000	9,021,000	13.6	55	7,471,000	6,530,000	14.4	86	4,284,000	3,926,000	9.2
	March	64	2,861,000	2,547,000	12.3	65	10,203,000	8,902,000	14.7	56	6,692,000	5,754,000	16.5	86	4,193,000	3,780,000	11.0
	April	64	2,756,000	2,357,000	17.0	65	8,601,000	7,765,000	10.7	56	7,132,000	6,094,000	7.0	86	4,282,000	3,821,000	12.1
	May	64	2,640,000	2,253,000	17.2	65	9,495,000	8,118,000	16.9	52	6,912,000	5,914,000	16.9	86	4,173,000	3,883,000	7.5
	June	64	2,641,000	2,290,000	15.4	65	9,281,000	8,017,000	15.7	53	6,718,000	5,563,000	20.9	86	4,480,000	4,174,000	7.4
	July	64	2,634,000	2,205,000	19.4	65	8,919,000	7,687,000	16.1	53	6,690,000	5,643,000	18.6	86	4,482,000	4,110,000	9.2
	August	64	2,352,000	2,025,000	16.2	65	9,021,000	7,881,000	14.5	53	6,910,000	5,718,000	20.9	87	4,819,000	4,270,000	12.9
	September	64	2,811,000	2,362,000	19.0	64	9,139,000	7,963,000	14.7	53	7,232,000	6,177,000	17.1	87	4,636,000	4,355,000	6.4
	October	64	3,057,000	2,530,000	20.7	66	10,683,000	9,173,000	16.5	52	7,422,000	6,304,000	17.8	85	4,586,000	4,327,000	6.1
	November	64	3,391,000	2,834,000	19.7	65	10,159,000	8,873,000	14.5	52	8,454,000	7,063,000	19.7	84	4,661,000	4,410,000	5.9
	December	63	3,425,000	2,953,000	16.1	54	9,805,000	9,103,000	7.7	43	7,409,000	6,211,000	19.3	79	3,816,000	3,710,000	2.9
			1917	1916			1917	1916			1917	1916			1917	1916	
KW.-HR. OUTPUT	January	64	120,211,000	93,163,000	29.1	66	564,699,000	429,432,000	31.5	56	437,923,000	351,335,000	24.5	86	363,094,000	298,990,000	21.4
	February	64	110,114,000	88,324,000	24.7	65	418,407,000	341,877,000	22.5	55	373,988,000	323,158,000	15.8	86	326,891,000	274,079,000	19.3
	March	64	121,434,000	95,515,000	27.2	65	539,028,000	425,376,000	27.0	56	383,046,000	311,841,000	23.0	86	365,541,000	301,721,000	21.3
	April	64	108,968,000	87,237,000	25.0	65	449,445,000	362,752,000	24.0	56	390,103,000	317,505,000	22.9	86	368,557,000	309,474,000	19.1
	May	64	110,991,000	86,675,000	28.3	65	527,004,000	405,719,000	30.3	52	415,795,000	325,986,000	27.7	86	394,554,000	336,541,000	17.3
	June	64	106,817,000	87,345,000	22.4	65	496,784,000	392,905,000	26.5	53	393,770,000	318,316,000	23.6	86	399,622,000	358,727,000	11.2
	July	64	109,399,000	83,451,000	31.4	65	494,965,000	396,538,000	24.8	53	379,087,000	311,931,000	21.5	86	412,635,000	366,237,000	12.7
	August	64	105,848,000	85,113,000	24.5	65	514,254,000	420,806,000	22.3	53	415,966,000	333,549,000	24.7	87	413,462,000	381,353,000	8.3
	September	64	114,339,000	92,319,000	24.0	64	482,112,000	405,070,000	19.0	53	399,480,000	345,953,000	15.5	87	379,221,000	374,685,000	1.4
	October	64	121,666,000	94,853,000	28.5	66	589,242,000	472,619,000	24.5	52	417,018,000	351,713,000	17.0	85	394,223,000	359,955,000	9.6
	November	64	130,311,000	108,561,000	20.0	65	532,301,000	445,537,000	19.6	52	443,374,000	384,480,000	15.2	84	379,384,000	357,535,000	6.1
	December	63	133,955,000	109,903,000	21.7	54	477,040,000	432,731,000	10.3	43	360,800,000	319,471,000	13.0	79	316,290,000	314,366,000	0.6

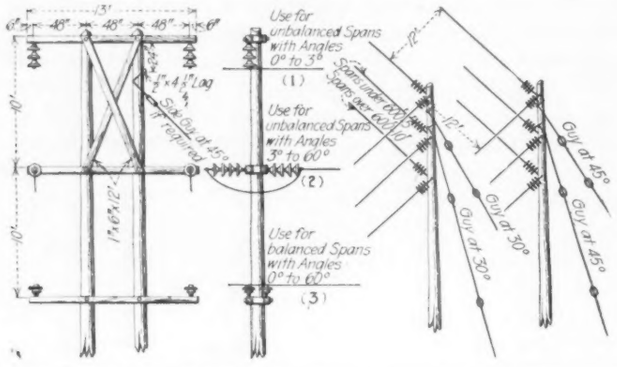
STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

TYPICAL LINE CONSTRUCTION OVER ROUGH TERRITORY

California Company Extends Service Into Mining Regions of North Feather River District Over 60-Mile Route

A 44,000-volt transmission line has recently been completed by the Great Western Power Company over a 60-mile (96.6-km.) route which affords a typical example of the requirements and practice in the rough mountainous sections of northern California. In this length of line there are thirteen crossings of the North


Use for unbalanced Spans with Angles 0° to 3°
(1)
Use for unbalanced Spans with Angles 3° to 60°
(2)
Use for balanced Spans with Angles 0° to 60°
(3)
Guy at 45°
Guy at 30°
Guy at 30°
Guy at 45°

FIGS. 1 AND 2—45,000-VOLT SPECIAL TWO-POLE TOWER, AND POLE TOPS FOR ANGLES OVER 60 DEG.

Fork of Feather River, with spans ranging up to 1500 ft. (457.2 m.) in length. Twenty per cent of the poles had to be hauled up to the line with block and tackle. The line was built to supply mining power load and connects the Big Bend generating station with the Veramont substation near the town of Taylorsville.

In considering what type of construction to use the likelihood of a desire to increase the voltage later to 100,000 had to be considered, as well as the need for mechanical strength of the line required in rugged country and the present high cost of materials and labor. The 3000-kva. load for which each of the two circuits on the line was designed could be carried easily at 45,000 volts, and this voltage was selected. The question of insulators received careful attention, and it was found that by using the pin type (O. B. No. 11,623) the cost per pole would be $4 per three-phase circuit, including pins, as against $15 for the suspension type, including hardware. The insulators selected are of the new design, two-part type, tested for 145,000 volts.

For the mechanical strength required it was thought best to use three-strand No. 4 hard-drawn copper wire. Wooden poles were used, 35 ft. to 50 ft. (10.7 m. to 15.2 m.) in length, and for ordinary spans the cross-arms were spaced 5 ft. (1.5 m.) apart. Additional clearance was provided by making the center cross-arm 9 ft. (2.7 m.) in length, while the others were 7 ft. (2.1 m.) long. For spans over 600 ft. (182.8 m.) double-pole construction was used, with 13-ft. (3.96-m.) cross-arms and a cross-arm spacing of 10 ft. (3 m.).

The Veramont substation at the Taylorsville end of the line is equipped with a bank of three 1150-kva. transformers. These were Y-connected as a compensator bank to keep down transformer investment and to reduce likelihood of arcs and grounds. With this arrangement transformers at generating plant and substation are interchangeable. In accordance with the Railroad Commission's orders for power lines paralleling lines of communication, the transformers were equipped with a low-tension delta winding for 22,000 volts. This winding, in addition to satisfying the requirements for a path for the third harmonic residual components of current and voltage, also afforded a source of supply for local service in the town of Taylorsville. The station is arranged to be as nearly automatic as possible, and a bell alarm system, connecting with the patrolman's house near by, gives warning of automatic switch operation. When the patrolman is out on the line his wife answers trouble signals that come in. So, although no operator is stationed at this point, there is virtually constant attendance. The regulation on the line is expected to be within 15 per cent.

From the Veramont station several short lines have been built to mining properties near by. One of these was a 16-mile (25.7-km.) line, recently built to the Walkers Brothers' copper mine over very rough country in record-breaking time. A bridle trail cut along the line was the only means of transportation, and all supplies and materials came in on horseback. Fortunately, it was possible to cut nearly half the poles required near the point where they were erected. The cross-arms were cut from local timber by the sawmill in service at the mine to which the line was being built.

One of the important problems on this line was the question of digging the pole holes, which would be for

MATERIALS FOR ONE POLE TOP

Two poles, 45-ft., class B.
Six cross-arms, 5 in. by 6 in. by 13 ft.
Twelve machine bolts, ⅝ in. by 22 in.
Twenty-four washers, ⅝-in. cut.
Six space blocks (field cut).
Two pieces 1-in. by 6-in. by 12-ft. rough pine.

INSULATORS AND HARDWARE

(1) Eighteen O.B.-11,535 insulators.
Six O.B.-11,545 socket clevises.
Six open eyes, 2-in.
Six machine bolts, ⅝ in. by 8 in.
Six washers, ⅝-in. cut.

(2) Forty-eight O.B.-11,535 insulators.
Twelve O.B.-11,545 socket clevises.
Twelve open eyes, 2-in.
Twelve machine bolts, ⅝ in. by 8 in.
Twelve washers, ⅝-in. cut.

(3) Twelve O.B.-11,623 insulators.
Twelve round-pipe pins, 1¼ in. by 14 in.
Twelve machine bolts, ½ in. by 6 in.
Twenty-four washers, ⅝-in. cut.

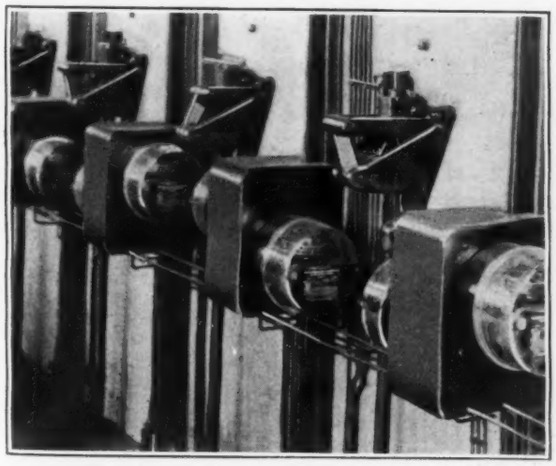
the most part in hard rock. The cost of digging these in this remote region with the ordinary crew would have been very high. This difficulty was surmounted in a very satisfactory way by contracting with a crew of miners from a nearby mine, who agreed to blast out holes at the points designated for a flat rate of $4 per hole. The depth specified was 5½ ft. (1.65 m.). These men, familiar with local conditions, did the job speedily and profitably. They usually worked from daylight to dark. Their earnings over and above explosives varied widely with the conditions and ranged all the way from $2 to $12 per man per day.

This line was for 22,000 volts with a capacity of 1000 kva., the conductors being No. 6 hard-drawn copper, and poles were spaced 20 to 24 per mile (12 to 15 per km.). The line was in service, with a 25-ft. (7.6-m.) right-of-way cleared through heavy growth, forty-five days after work was started.

PANELBOARD SIMPLIFIED BY MOUNTING RELAYS ON BACK

Accidental Operation of the Relays Avoided by Placing Them Above Mopping and Sweeping Zone

By mounting a group of time-element overload relays on the rear of the switchboard as shown herewith, the United Electric Light Company of Springfield, Mass., greatly simplified the front of the panels and brought the relays well above the "high-water mark" of the mopping zone. The only apparatus on the front of each panel consists of the trip and operating handles for one Condit D-12 oil-switch, a General Electric polyphase watt-hour meter and a Westinghouse alternating-current ammeter. The switch rods con-



TERMINALS ARE PROTECTED BY ASBESTOS-BOARD HOUSING

necting the bell-crank levers are carried under the floor, thus making unnecessary the board walk sometimes seen behind switchboards.

The terminals of the relays are protected, being housed in asbestos board boxes screwed into the angle-irons forming the panel framing. The boxes are 10 in. (25.4 cm.) deep, 8 in. (20.3 cm.) high, and either 3⅝ in. or 5 in. (9.2 cm. or 12.7 cm.) wide, according to whether one or two sets of relay binding posts are housed in each box. The asbestos sides are ⅜ in. (0.95 cm.) thick, and the top, front and bottom of each box is of a single sheet-iron plate which springs readily when it is desirable to remove the cover to examine the terminals.

OUTDOOR DISTRIBUTION RACK USED FOR OVERHEAD SERVICE

New England Company Builds Neat Structure of This Character for Supporting Wires on Outside of Station

An interesting distribution rack used in connection with a substation of the Edison Electric Illuminating Company of Brockton, Mass., is shown herewith. From the low-tension transformer coils and switching equipment the various circuits are brought out of the substa-

DISTRIBUTION RACK ON EXTERIOR OF STATION

tion in conduit and are extended upward along the outer wall to potheads that are connected with horizontal conductors supported on a pipe and angle-iron frame. From this structure the overhead circuits proceed to the various pole-line structures. The arrangement is neat, flexible and unusually satisfactory from the standpoint of mechanical strength.

INTERESTING RECORD OF POLES SET PER MAN

One Hundred and Twenty Poles Set in Day by Fifteen Men—Method of Subdividing Labor to Keep Each Man Busy All the Time

BY J. F. KEYS

The writer was interested in the article on page 1105 of the Dec. 8 issue of the ELECTRICAL WORLD recording the Georgia Railway & Power Company's record of setting sixty-eight poles in one day with twelve men. The construction gang of the Central Kansas Power Company of Gypsum, Kan., recently, with fifteen men, including a foreman, set and tamped 120 30-ft. and 35-ft. (9.1-m. and 10.6-m.) creosoted yellow-pine poles in one day, thus exceeding this excellent record of poles set per man employed by nearly 40 per cent.

The labor was subdivided as follows: Instead of the erecting gang tamping the poles in as is the usual custom, they did nothing but lift the poles into the holes. Two gangs of tampers of four men each followed. The work was so arranged that each man was kept busy all the time and had exactly the same duties

to perform at each pole, so that every man soon became skilled in his work. The foreman went with the erecting gang, helping at the butt of the pole and also lining the poles for the two tamping gangs, which followed closely. Good-natured rivalry between the tampers and the erecting gang, together with a slight bonus for the completion of the job by the end of the week, also helped speed up the work.

OPERATING A BROKEN CHAIN GRATE IN EMERGENCY

Holes in Grate Temporarily Covered with Barrel Staves to Hold Coal Until It Had Coked Sufficiently to Support Itself

An emergency arose recently in a small Western plant wherein it was necessary to operate two 400-hp. chain-grate stokers which had been taken out of service owing to holes in the grate as large as a man's hand. To permit operation under these conditions wooden barrel staves were placed over the holes as they appeared in front of the hopper. The staves prevented the coal sifting through the grates until they were nearly burned through, at which time the coal had coked enough to support itself. This scheme permitted operating the grates satisfactorily until the repair parts arrived.

PULL SWITCHES USED ON WHITE-WAY ELECTROLIERS

Ceiling-Type Pull Switch Having a Short Operating Chain Which May Be Pulled by Patrolman Is Used

Multiple electroliers for white way lighting are often switched by patrolmen on bicycles or motorcycles. Sometimes each individual post has its own switch and sometimes groups of posts are switched from one point.

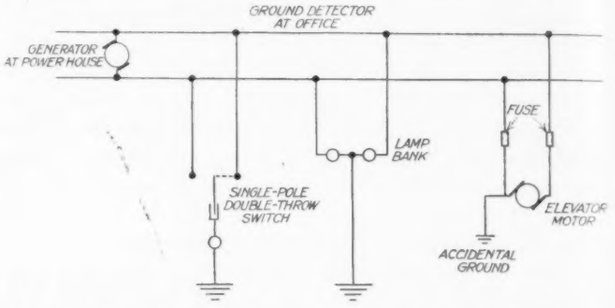
WHITE WAY LAMP EQUIPPED WITH PULL SWITCH

If switches of the knife type are placed in the base of posts, the patrolman must dismount at each switch to operate it. This inconvenience can be avoided by mounting a ceiling type pull switch equipped with a short operating chain having a ring at the end at each switch point. This arrangement is unobtrusive, yet the switch may readily be operated by the patrolman by means of a short hook stick, without the necessity of dismounting.

GROUND DETECTOR FOR ELEVATOR CIRCUITS

Device Installed in Central-Station Office Notifies Company's Employees of Grounds Occurring on Consumers' Premises

A device consisting of a lamp bank and a water rheostat is effectively used by the Memphis (Tenn.) Gas & Electric Company for detecting grounds on consumers' elevator circuits. Pairs of lamps are conveniently placed in various places in the company's of-



WIRING DIAGRAM OF GROUND DETECTOR FOR ELEVATOR CIRCUITS

fice and testing rooms so that a ground can be immediately detected by any one observing their behavior. Two lamps are placed in series across the line with their common point connected to a grounded water pipe. The water rheostat, as shown in the diagram, has one terminal attached to the water pipe and the other arranged so that it may be connected to either side of the line by means of a double-throw, single-pole knife switch.

If a motor circuit becomes grounded, the lamp on the grounded side of the line will be extinguished. The water rheostat is then connected to the opposite side by means of the knife switch and its resistance increased until sufficient current is created to blow the fuse of the offending circuit. If the operator of the motor replaces the fuse, it will immediately be blown again, so that after several trials he will invariably call up the company and report the trouble. A man can then be sent to the premises from which the difficulty is reported, and the exact location of the ground will be discovered in short order.

When the ground is within the motor the lamps will be alternately lighted and extinguished as the elevator goes up and down and reverses the current through the motor. By observing the time interval between reversals the central-station employees can tell approximately what building the ground is in, since in the high buildings the time between reversals is longer than in low buildings.

When this system was first installed it was necessary because of faulty cable to use high-wattage lamps to give a high resistance to ground. Since the cable trouble has been removed the size of these lamps has been reduced to 10 watts. The accuracy of the device is also increased with the decreasing of the resistance to ground.

It has been found that the device always warns the central-station men of grounds and performs a twofold protective function in eliminating loss of current to ground or possible short circuit from grounds on both sides of the circuit.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

UTILITY AGREES WITH CITY TO THAW FROZEN PIPES

Ohio Company Bills City at $15 per Service for Water Pipes Up to 1½ In. Diameter and Along Established Lines

A contract has just been entered into with the city of Sandusky, Ohio, whereby the Sandusky Gas & Electric Company is paid $15 per service for thawing out frozen water pipes up to and including 1½ in. (3.81 cm.) in diameter. For each ½ in. (1.27 cm.) increase in size of pipe above 1½ in. $1 additional is charged. This price covers the work along the established lines of the company. Where an extension of more than 200 ft. (60.9 m.) is required $1 extra is charged for each additional 100 ft. (30.4 m.) of service extension.

In addition, the city furnishes the necessary vehicle to convey the equipment from place to place and an experienced waterworks man to look after the water piping. The city makes all arrangements with the customer and makes collections, and the company bills the city each month for the service rendered. The average time required to thaw out an ordinary service after the current is applied is about eleven minutes.

This does not only mean a substantial profit to the company, but a considerable saving to the city, for were it not for this system being employed, in many instances it would become necessary to take up the pavement in the streets in order to thaw out the frozen pipes by other methods.

The rates in this case are similar in many ways to those used by the Binghamton (N. Y.) Light & Power Company. The latter were described in the ELECTRICAL WORLD for Feb. 16, page 363. Both properties are under the management of the W. S. Barstow Management Association, Inc.

SMALL-COMPANY RATE ADVANCE ANNOUNCEMENT

Interesting Letter That Served to Convince the Public of the Fairness of a 15 per Cent Increase in Company's Charges

As a small-company letter which put the need of a 15 per cent rate advance in a few words and served to convince the public of the fairness of the company's position, the following is interesting. The property is situated in Randolph, Mass., a town of fewer than 5000 inhabitants:

The cost of producing and distributing the electricity used by our customers in Randolph and Holbrook has almost doubled during the past year, due to the increased cost of coal, labor, material, etc. We have kept our local expenses at the lowest possible figure consistent with the maintenance of the best service that the company could give to you.

These increased costs, due solely to war conditions, over which we have no control, make it necessary for us to ask your co-operation by paying for electricity used for lighting, from Feb. 1, 1918, 16 cents per kilowatt-hour, subject to a discount of 1 cent per kilowatt-hour for payment in ten days, making a net rate of 15 cents per kilowatt-hour. This is an increase of but 15 per cent as compared with increases of from 25 per cent to over 100 per cent in the cost of coal, material, supplies and other expenses necessary to supply you with this service. This advance in the price of electricity is necessary to enable this company to continue to pay for energy, labor, taxes, insurance, interest, depreciation, and for the repairs and maintenance required to keep the property of the company in fit condition to serve you.

This increased cost must be regarded as being entirely due to present war conditions, and immediately upon the company receiving any relief from the same a reduction in the price will be made at once in proportion to the relief so secured.

I have the co-operation of E. S. Hamblen, our former superintendent, in solving the problems brought about by these war conditions.

Thanking you for the co-operation you have always given to me and to this company, and trusting you will give me an opportunity to talk with you personally if you feel that this is not a fair rate, I remain yours very truly,

RANDOLPH & HOLBROOK POWER & ELECTRIC COMPANY.
By T. H. DOWD, Superintendent.

A SCHEME FOR ENDING APPLIANCE REPAIR FRAUDS

System of Checks Containing All Repair Data Designed to Prevent Customer from Getting New Devices for Broken Ones

A new repair check system has just been devised by the Harrisburg Light & Power Company of Harrisburg, Pa., for the purpose of putting an end to the petty fraud that creeps into repair department work unless some measure of protection is taken. Not a little trouble has been met in the past owing to the fact that customers would bring in a flatiron or some other heating device to be repaired and on receiving it back would assert that it was not their appliance and that another one had been substituted. Of course, the repair department record would show that an appliance had been received and returned, but it would not prove that it was the identical appliance brought in by this particular customer. The tag, for instance, might have been changed; yet upon investigation of these claims it was found repeatedly that the customer was simply trying in this way to get a new appliance for an old one.

To make this kind of thing impossible the Harrisburg company is now using a simple system of checks numbered in duplicate. The check which is attached to the appliance bears full information as to the number of the appliance, the repair needed, promise of delivery, name of the owner and the charge agreed upon for the work. The stub is given to the owner and must be surrendered and signed in order to secure the appliance. This protects both the customer and the company and does not

put the company in a position where it has to give the customer the benefit of the doubt and present him with a new appliance in order to avoid losing his good will.

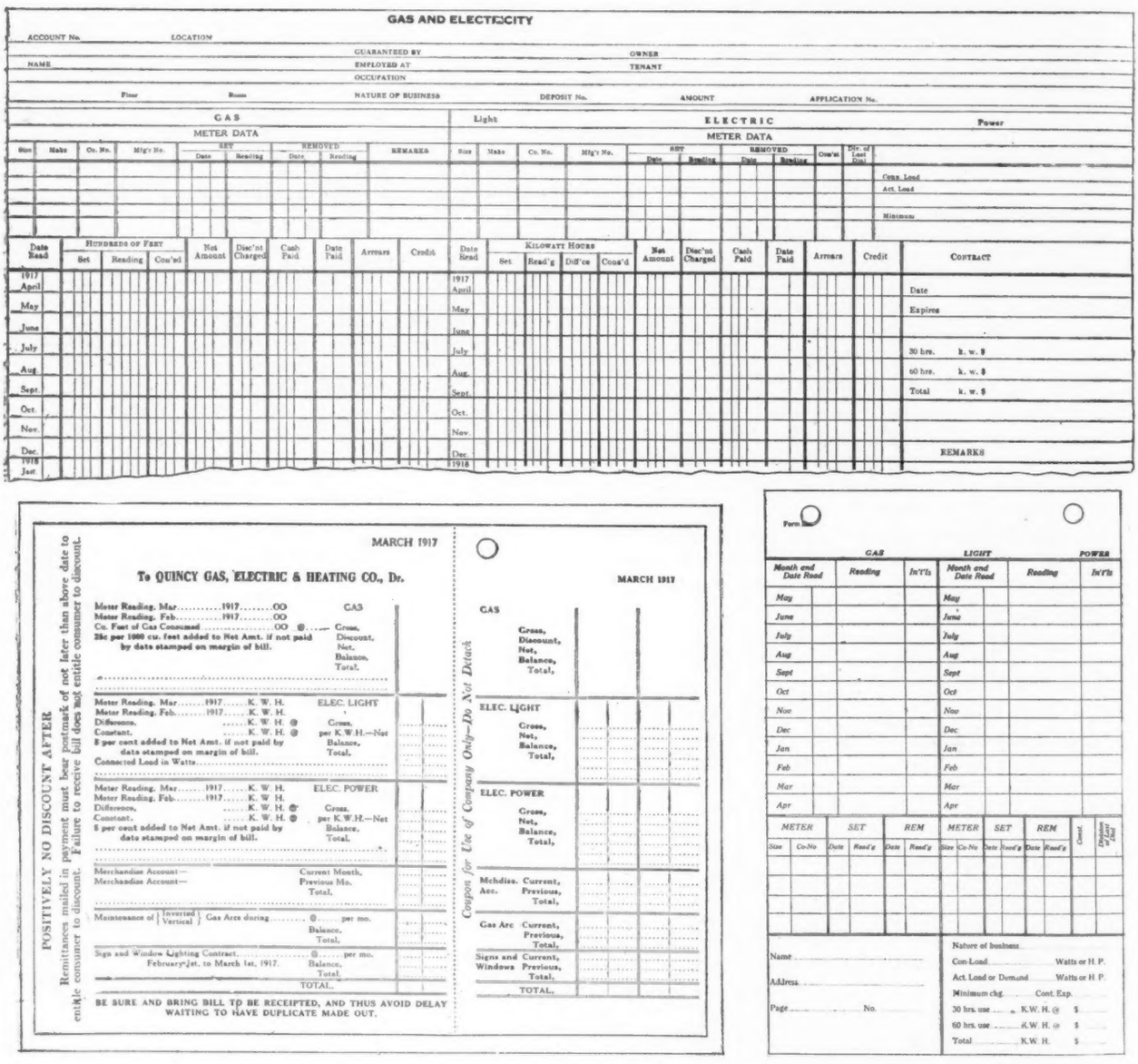
COMBINATION GAS AND ELECTRICAL BILLING

Quincy (Ill.) Company Uses Combination Reading Slip, Combination Bill and Combination Ledger —Finds System Highly Satisfactory

A number of combination gas and electric companies have recently found it advisable as a matter of economy to combine gas and electric meter reading and billing. This is not a new practice, but one that has been growing for some time and has lately received a noticeable increase.

For three years the Quincy (Ill.) Gas, Electric & Heating Company has been using combination meter-reading and billing forms. Three of the printed forms—a reading slip, a combination bill and a ledger page—are reproduced herewith. The gas and the electric meter are read at the same time. The company uses the continuous system of meter reading and has a discount day every fifth day. This plan economizes not only the time of the meter reader, who makes but one round to get all readings, but also the time of the customer, who needs to call at the office only once to pay both bills. If the customer pays his bills by check, the combination bill saves him postage and effort. The plan of having a discount day every fifth day is considered a good compromise between the old idea of a discount day once a month and that used by larger companies of having every day a discount day. The combination ledger, which is the loose-leaf type, is a time saver for the office force when used in connection with the combination reading slip.

In speaking of the combination plan of billing and reading meters, H. O. Channon, manager of the company, said: "The system effects a saving in labor and material and gives good satisfaction to the customer, so it seems that there is little excuse for using any other."



MARCH 1917
To QUINCY GAS, ELECTRIC & HEATING CO., Dr.
POSITIVELY NO DISCOUNT AFTER
Remittances mailed in payment must bear postmark of not later than above date to entitle consumer to discount. Failure to receive bill does not entitle consumer to discount.
Meter Reading, Mar. 1917 OO
Meter Reading, Feb. 1917 OO
Cu. Feet of Gas Consumed OO @
25c per 1000 cu. feet added to Net Amt. if not paid by date stamped on margin of bill.
GAS
Gross, Discount, Net, Balance, Total.
Meter Reading, Mar. 1917 K. W. H.
Meter Reading, Feb. 1917 K. W. H.
Differens. K. W. H. @
Constant. K. W. H. @
5 per cent added to Net Amt. if not paid by date stamped on margin of bill.
Connected Load in Watts
ELEC. LIGHT
Gross, per K.W.H.—Net Balance, Total.
Meter Reading, Mar. 1917 K. W. H.
Meter Reading, Feb. 1917 K. W. H.
Differens, K. W. H. @
Constant, K. W. H. @
5 per cent added to Net Amt. if not paid by date stamped on margin of bill.
ELEC. POWER
Gross, per K.W.H.—Net Balance, Total.
Merchandise Account—
Merchandise Account—
Current Month, Previous Mo. Total.
Maintenance of { Inverted / Vertical } Gas Arcs during @ per mo.
Balance, Total.
Sign and Window Lighting Contract, @ per mo.
February 1st. to March 1st. 1917.
Balance, Total.
TOTAL.
BE SURE AND BRING BILL TO BE RECEIPTED, AND THUS AVOID DELAY WAITING TO HAVE DUPLICATE MADE OUT.
Coupon for Use of Company Only—Do Not Detach
MARCH 1917
GAS
Gross, Discount, Net, Balance, Total,
ELEC. LIGHT
Gross, Net, Balance, Total,
ELEC. POWER
Gross, Net, Balance, Total,
Mchdise. Current, Acc. Previous, Total,
Gas Arc Current, Previous, Total,
Signs and Windows Current, Previous, Total,
TOTAL.

FORMS USED IN THE HANDLING OF GAS AND ELECTRIC ACCOUNTS IN COMBINATION: (A) COMBINATION LEDGER PAGE FOR LOOSE-LEAF SYSTEM; (B) THE COMBINATION BILL; (C) THE COMBINATION READING SLIP

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Notes on the Design of Electromagnetic Machines.—STANLEY PARKER SMITH.—In Part I of the article the author dealt with some of the main principles underlying the design of alternating-current generators. In Part II these principles were applied to the design of a low-speed, three-phase alternator, giving 750 kw. at 2200 volts when running at a speed of 250 r.p.m. In this, the third, part a three phase turbo-alternator is designed to give 2000 kw. at 3000 r.p.m. at a line voltage of 500, and the mechanical stresses in the rotor are discussed.—London *Electrician*, Feb. 1, 1918.

Lamps and Lighting

Economics in the Operation of Large Lighting Installations.—CLARENCE L. LAW and JAMES E. BUCKLEY.—This paper describes the details and routine necessary to the economic operation of lighting installations served by central stations, with particular reference to the systems of the illuminating engineering department of the New York Edison Company. Surveys and subsequent recommendations based thereon cover the preliminary steps and layout of a new installation or in the improvement of an old one. The paper includes sample illumination tests, tabulations and curve sheets showing location of lamps, horizontal intensities, average foot-candles, current consumption and weather charts.—*Transactions of the Illuminating Engineering Society*, Feb. 11, 1918.

Generation, Transmission and Distribution

Electrical Propagation Upon an Open-Circuited Line.—E. BRYLINSKI.—A very elaborate mathematical discussion of this subject by means of methods derived directly from the methods previously employed by Lord Kelvin and Vaschy in the case of a short circuit. It seems evident that the closing of a circuit breaker in an open-circuited line in good condition is not in itself dangerous. Were there condensers, coils or other apparatus in the circuit, it might be otherwise; but this would present a more complicated case demanding new studies.—*Revue Générale de l'Electricité*, Jan. 12, 1918 (reprinted from the *Bulletin de la Société Internationale des Electriciens*).

Water Powers of New England.—HENRY I. HARRIMAN.—After giving an outline of the amount of water power developed in the New England States, the additional amount which can be developed, the amount of coal which would be saved thereby, and the total fall in the principal rivers of New England, the author discusses the relative economy of steam and water-power generating stations. The latter involves a consideration of the ability of each to carry peaks and loads of high load factor, the requirements of the water power for auxiliary electricity during periods of low river flow, and the ability of the steam station to supply this need without added capital expense. Basing his statements on some reliable figures, the author says that the fixed charges on a steam plant might be almost half of those on the corresponding hydroelectric plant, whereas the operating expense for the hydroelectric plant may be one-eighth to one-twentieth that of a steam plant, this range being due to the difference in sizes of steam plants, their load factors and efficiencies. Whether the statement that one-half of the capacity of central stations is idle 95 per cent of the time be correct or not, it is certainly true that every station must have a very large carrying capacity during the greater portion of the year; but, fortunately for both steam and hydroelectric plants, the period of low water occurs during the summer and early fall, when the central station load is at its minimum. All of these facts lead to the conclusion that the large steam plant and hydroelectric station can be developed economically, depending on the service for which it is best suited and each giving to the other the economy which neither could have alone. In closing, the author says that the water powers of New England are to-day producing more than 2,000,000,000 kw.-hr. of energy. If this energy were produced by coal, it would mean an annual consumption of 3,000,000 tons.—*Journal of the Boston Society of Civil Engineers*, December, 1917.

Forces Which Act Upon a Transmission Line.—CHARLES R. HARTE.—Data are given by means of which the factor of safety of a pole line can be calculated.—*Electric Railway Journal*, Feb. 23, 1918.

Traction

Saving Fuel Through Operating Economies.—A committee of engineers shows how more than 25,000 tons of coal can be saved yearly on Washington electric railways. The report by Messrs. Renshaw, Lamber and Layng estimates that an annual saving in coal of 25,790 tons could be made by the Washington electric railways, as follows:

Source of Saving	Tons per Year
Skip-stop plan	9,400
Double berthing and modifying rapid-transit stops	600
Eliminating unnecessary mileage in non-rush hours	3,220
Reducing heat 50 per cent	2,250
Shutting down small plants to effect the same load reduction as would carrying all Capital Traction Company's load by Potomac Power Company	9,700
Staggering office hours of government departments	620
Total	25,790

If heat is shut off during peaks instead of being reduced 50 per cent all day, the saving would be 1500 tons instead of 2250 tons and the above total would be correspondingly reduced.—*Electric Railway Journal*, Feb. 9, 1918.

The Coire-Arosa Railway.—An account, taken from the official publication of Brown, Boveri & Company, of the Coire-Arosa electric railway in Switzerland. Energy at 2000 volts direct current is supplied by a trolley line actuated from a power house at Coire, each

car containing four series motors.—*Revue Générale de l'Electricité*, Jan. 12, 1918.

Installations, Systems and Appliances

The Electric Furnace for Melting Ferromanganese.—At a meeting of chemists in Sweden J. Harden stated that the electric furnace was particularly suitable not only for the production of ferromanganese but also for melting it. The ease of control of temperature afforded by the electric furnace and the avoidance of loss of material which it insures render this the best means of melting the alloy. Any type of furnace will serve, but the induction type is the most economical. The cost of operation is about 20 shillings per ton of ferromanganese. In addition to the even temperature maintained, there is a considerable economy of time and material, important items, especially with ferromanganese at its present price of £75 per ton.—London *Electrical Review*, Feb. 1, 1918.

Motor Versus Engine Drive for Pumping Plants.—This article summarizes an investigation of practices and tests of pumping equipment that show advantages of electric drive. Observations from practice, comparisons of electricity and other forms of power for pumping, electric pumping costs, selection of the motor and the economics of operation are taken up.—*Railway Electrical Engineer*, February, 1918.

Wires, Wiring and Conduits

Combined Table of Sizes in the Principal Wire Gages.—This table combines in one series the sizes in the American (B. & S.) steel, Birmingham (Stubs'), British standard and metric wire gages, arranged in order of diameters of wires. It gives the diameters of all the gage numbers in these five systems, in mils, inches and millimeters, also the cross-sections in square mils, circular mils, square inches and square millimeters. The table is specially useful to manufacturers who wish to determine the nearest equivalent in American or British gage sizes of wires specified in millimeters or square millimeters, or vice versa.—*Bureau of Standard Circular* 67.

Electrophysics and Magnetism

A General Method for Studying Periodic Currents.—JOHN MILLS.—The method illustrated may be summarized as follows: (1) The concept of the vector operator i; (2) the concept of a rotating vector and its expression in an equation; (3) the rate of change of a rotating vector; (4) the concept of a conjugate vector; (5) the representation of a simple harmonic motion, *e. g.*, an alternating current, by the sum of two conjugate vectors; (6) the representation of a damped alternating current by the sum of two conjugate vectors which are similarly reduced exponentially. With the tools thus obtained the transients of spark-set wireless transmitters, the oscillations of tuned and coupled circuits, the currents in unbalanced three-phase circuits, the impedances of transmission lines and other similar magnitudes may be dealt with quantitatively by purely algebraic methods. As a by-product of this method a method is suggested for approaching trigonometry which might be used with some types of students to shorten the time now required for its study.—*Bulletin of the Society of Engineering Education*, January, 1918.

Electrical and Thermal Properties of Iron Oxide.—D. C. BIDWELL.—Data on the electrical resistance and thermo-electric power of specimens of iron oxide, with information on thermal conductivity of Fe_2O_3. The work is an extension of previous research, having been carried to the melting point of the oxides studied (1520 deg. C.). The electrical resistance in the case of Fe_2O_3 is found to obey the exponential law suggested by Königsberger. When plotted to the corresponding logarithmetic equation the two transformations revealed by thermo-electric power lines are strikingly corroborated. Owing to the change in composition of Fe_3O_4 which occurs on heating, the pure temperature variation is masked, but a wide difference from the behavior at Fe_2O_3 is shown. The change of thermal conductivity of Fe_2O_3 with temperature is found to be a linear one up to 1050 deg. C., the limit of the investigation, although a transformation takes place at 720 deg.—*Physical Review*, December, 1917.

Small Electromagnet for Medical Men.—In order to facilitate the work of the surgeon who wishes to pick out small particles of iron from the human body, Prof. G. Sultan has devised a small handy electromagnet. The magnet is held by a fork which is pivoted on a small stand and can thus be swung around and inclined at will; the magnet can further be shifted in its fork by means of a hand wheel, so that the conical pole piece can be adjusted to any particular spot. The instrument is illustrated in the *Elektrotechnische Zeitschrift* of Oct. 8, 1917.—London *Engineering*, Jan. 25, 1918.

Electrochemistry and Batteries

Storage Batteries on the Italian Railways.—FRANCESCO ROSSI.—An account of the use of storage battery cars on the state railways of Italy and of their costs in comparison with steam traction. The author figures a difference in their favor as regards operating charges of 24.6 per cent and predicts a wide and varied use for the "automotrici" and storage-battery locomotives in Italian industry after the war.—*L'Ettrotecnica*, Jan. 5, 1918.

Telegraphy, Telephony and Signals

Telephony Over Telegraph Lines.—REGNONI.—A description of the Castelli and other apparatus for establishing telephonic communication over a single-wire telegraph line with return through the earth. The problem is, of course, hardest where there is induction to be overcome. V. E. Castelli, chief inspector of the Italian state railroads, has perfected two sets of apparatus—one for short and one for long distances.—*Revue Générale de l'Electricité*, Jan. 12, 1918 (abstracted from the *Rivista Tecnica delle Ferrovie Italiane*, July, 1917).

Loading Coils Versus Repeaters.—W. N. FURTHMANN.—In previous articles on loading coils and repeaters the discussion has shown that the difference of impedance of two telephone circuits or sections it is proposed to join causes reflection losses in telephone transmission. Losses of this kind are present in sections composed either of loaded or non-loaded conductors. The author points out that in loading a telephone circuit it is necessary to consider these losses, as they vitally affect the amount of current that will be received at the end of the line. Since loading coils are fundamentally required to insure a sufficient amount of current at the receiving end of the line, it follows clearly that terminal transformers should be employed in the

common cause. Terminal transformers of high efficiency are certain to contain some transmission loss. The problem involved in their use, therefore, requires careful analysis. They cannot consistently be used where their inherent loss is greater than the good they are to accomplish. The author brings out data in the form of patents which show on their face that terminal losses were not considered in the original invention of a repeater.—*Telephone Engineer*, February, 1918.

Telephone Exchange Transfers and Their Organization.—F. G. C. BALDWIN.—The author points out that transfers may be effected in three ways, as follows: (a) By transferring each line independently; (b) by transferring the subscribers in groups, and (c) by transferring the whole of the lines at one operation. The author points out that method (a) possesses certain commendable features, but traffic considerations unfortunately preclude the adoption of this method. Method (b) has similar, although less, serious objections. Method (c) is the one usually adopted. From a traffic point of view difficulties are reduced to a minimum; the actual operation can be carried out expeditiously—the time being measured in seconds—and a period can be selected for the change when it is known that the traffic will be at a minimum and when least possible interruption to the service will ensue. The author discusses in detail line plant considerations, methods of effecting transfer, preparatory line work, preparatory work at subscribers' stations, preparatory work at old exchange, at new exchange, final preparations, the transfer operation, and traffic and operating considerations.—London *Electrician*, Feb. 1, 1918.

Miscellaneous

Gravitational Repulsion.—FRANCIS E. NIPHER.—In this paper the author describes experiments which, he says, indicate that gravitational attraction between masses of matter depends upon their electrical condition. Not only has gravitational attraction been diminished by electrification of the attracting bodies, says the author, when direct electrical action has been wholly cut off by metal shields, but it has also been made negative or converted into repulsion. This result has been obtained many times. On one occasion the repulsion was made somewhat more than twice the normal attraction. The peculiar feature of the experiments was, however, that passing direct current through the bodies being studied had no apparent effect, the force of gravitation being offset only by using alternating current.—*Transactions of the Academy of Science of St. Louis, Vol. XXIII, No.* 5.

Distillation of Coal.—E. PIERNET.—A plea for distilling all coal that can be so treated for fuel purposes and an account of efforts along this line made in England, Switzerland and Germany. The author says also that by the use of special apparatus tar and pitch may be utilized directly as fuel.—*Revue Générale de l'Electricité*, Jan. 12, 1918.

Masonry in the Central Station.—L. CONGE.—An inquiry into the building and care of furnace walls. The author takes up the quality of the material, considering both ordinary and refractory brick and also the mortar best suited to the work; the care that should be exercised in construction, and the reactions from the temperature or from the composition of the cinders. The effects of calcareous water on masonry are also mentioned.—*Revue Générale de l'Electricité*, Jan. 12, 1918.

A Substitute for Copper.—German industrial circles are very much interested in the discovery of a new alloy which, it is said, will replace copper for technical purposes. The new metal is said to have a greater density than copper and lower elongation, while being an excellent conductor of electricity. A certain number of tests have already been made on the alloy, and a representative of the A. E. G. is in negotiation with the inventor with a view to acquiring the patent rights. The A. E. G. will probably grant a license to a large foundry at Lausanne to manufacture the substitute. "Lack of detailed information," says the editorial comment, "forbids us to comment with any approach to conviction on the matter, but we may point out that hitherto experience has indicated that any alloy of two metals may be expected to possess a higher resistivity than one of its constituents. Hence, while it would be reckless to deny the possibility of producing an alloy with high conductivity, we are very skeptical as to the reliability of the inventor's claim in this respect."—London *Electrical Review*, Jan. 25, 1918.

Turbo-Rotor Cap Rings.—R. ROBERTS.—The author investigates the calculation of stress in turbo-rotor cap rings and by means of examples shows how these stresses may be calculated for some commonly used designs. In conclusion, the points that may be considered when designing these cap rings are summarized.—London *Electrician*, Jan. 18, 1918.

Electric Ship Propulsion.—A novel method of operating certain classes of overseas traffic is proposed by H. de M. Snell, which consists essentially in using one set of engines for a number of hulls. With the system proposed by Mr. Snell a set of Diesel engines driving electric generators is fitted in a steel caisson, which also contains the engineer's quarters. This caisson is mounted detachably on the stern of any one of perhaps five hulls. These hulls are to be fitted with electric motors driving the screw but with no other propelling machinery. On arrival at port the whole caisson is to be lifted by pontoons from the hull of the incoming vessel and transferred to one about to depart. This operation can, it is claimed, be effected very rapidly by the use of special pontoons. As the machinery caisson is to be mounted on the stern of the hulls, the whole of the propelling machinery is confined to the after end of the boat. It is claimed that with this arrangement more effective subdivision of the vessel is possible, giving greater security against torpedo attack.—London *Engineering*, Jan. 25, 1918.

Luminosity of Rectifier Electrode.—HARVEY B. LEMON.—In setting up as a demonstration experiment the well-known arrangement for rectifying an alternating current, the essential part of which is an aluminum rod and lead plate in 10 per cent sodium-phosphate solution, the following observation was made: When the aluminum rod is positive—that is to say, when the current is in such direction that it will not pass through the rectifier—a very distinct luminosity appears over the surface of the aluminum, and if the applied potential is as high as 250 volts, this luminosity becomes quite brilliant enough to be observed by a spectroscope. The observer asks for explanations of this phenomenon.—*Science*, Feb. 15, 1918.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

NEW OFFICERS OF THE ENGINEERING COUNCIL

J. Parke Channing Elected Chairman and Committees Appointed—Definition of the Council, Representing Now 33,000 Members

At the first annual meeting of the Engineering Council, on Feb. 21, J. Parke Channing was elected chairman, Harold W. Buck first vice-chairman, George F. Swain second vice-chairman and Alfred D. Flinn secretary. The following committees were appointed:

Executive committee: The chairman, the two vice-chairmen, and David S. Jacobus, Calvert Townley, George J. Foran.

Finance committee: E. Wilbur Rice, Jr., chairman; Charles F. Loweth, Sidney J. Jennings, David S. Jacobus.

Rules committee: J. Parke Channing, chairman; Clemens Herschel, Nathaniel A. Carle, Irving E. Moultrop.

Public affairs committee: Charles Whiting Baker, chairman; George F. Swain, Benjamin B. Thayer, E. W. Rice, Jr., Charles E. Skinner.

J. PARKE CHANNING

American engineering service: George J. Foran, chairman; George C. Stone, Alfred D. Flinn, Dr. Addams S. McAllister, Edward B. Sturgis, secretary.

War committee of technical societies: D. W. Bruntno, chairman; Arthur H. Storrs, secretary; James M. Boyle, Nelson P. Lewis (American Society of Civil Engineers), Edmund B. Kirby (American Institute of Mining Engineers), A. A. Greene, Jr., R. N. Inglis (American Society of Mechanical Engineers), Harold W. Buck, Dr. Addams S. McAllister (American Institute of Electrical Engineers), Dana D. Barnum, E. C. Uhlig (American Gas Institute), Joseph Bijur, Dr. Charles A. Doremus (American Electrochemical Society), Louis B. Marks, Preston S. Millar (Illuminating Engineering Society), Christopher R. Corning, George C. Stone (Mining and Metallurgical Society of America), Henry Torrance, F. E. Matthews (American Society of Refrigerating Engineers).

Fuel conservation committee: L. P. Breckenridge, chairman; Ozni P. Hood, secretary; Robert H. Fernald, Charles R. Richards, Charles L. Edgar, Carl Scholz, David Moffat Myers, Edwin Ludlow, Harold W. Buck.

The definition of the Engineering Council that was adopted declared that "The Engineering Council is an organization of national technical societies of America created to provide for consideration of matters of common concern to engineers, as well as those of public welfare in which the profession is interested, in order that united action may be made possible."

The Engineering Council is now composed of the American Society of Civil Engineers, the American Institute of Mining Engineers, the American Society of Mechanical Engineers and the American Institute of Electrical Engineers, having a membership of 33,000 and known as "founder societies." The new chairman, J. Parke Channing, is vice-president of the Miami Copper Company and the General Development Company.

Freezing While Nature's Storehouses Are Filled With Heat

MILLIONS OF HYDROELECTRIC HEAT AND POWER UNITS DAILY
NEW ENGLAND
HEATING SYSTEM DEPENDENT ON DISTANT FUEL SUPPLY
POWER SYSTEM DEPENDENT ON DISTANT FUEL SUPPLY

—Boston Sunday Advertiser and American

Presenting the Case for the Utilities

Committee Representing Utility Associations Brings to the Attention of Washington Authorities the Critical Situation Created by the War

A COMMITTEE appointed to represent four national associations of utilities in bringing to the attention of the authorities at Washington the critical situation in the public utility industry as brought about by war conditions has submitted a report. The committee consists of P. H. Gadsden, E. K. Hall and H. H. Crowell. Its report is made to the National Electric Light Association, American Electric Railway Association, American Gas Institute and National Commercial Gas Association.

It is the opinion of the committee that if the credit of the public utilities is to be preserved care must be taken of four phases of the situation:

1. Rates must be increased sufficiently to absorb the increased costs of producing the service.
2. The utilities must be relieved during the period of the war of all non-essential and unproductive requirements, such as paving, undergrounding of wires, duplication and unnecessary extension of service.
3. Some way must be found to enable the utilities to take care of obligations maturing while the war lasts.
4. Assistance must be provided to enable the companies to finance the unavoidable extensions of service made necessary by the nation's war program.

This analysis of the situation was presented by the committee to John Skelton Williams, Comptroller of the Currency. In his report to Congress, Comptroller Williams called attention to the conditions confronting the utilities, as stated in the ELECTRICAL WORLD of Feb. 9, 1918, page 318.

As a result of this analysis of the situation by the Comptroller, supplemented by additional information and representations to the Treasury Department by the committee, Secretary of the Treasury McAdoo presented the matter to the attention of President Wilson. The letter of Secretary McAdoo and the reply of the President are published below. The report of the committee continues:

The capital issues committee, which will be made a part of the organization of the War Finance Corporation, and before which your committee had a hearing lasting practically an entire day, has already stated that the policy of the national government will be to discourage the sale of

Maintain Utilities at Maximum Efficiency, Says the President

SECRETARY McADOO TO PRESIDENT WILSON

February 15, 1918.

DEAR MR. PRESIDENT:

I beg to hand you herewith several memoranda and letters relating to street railway and other local public utilities furnishing light, heat and power, which I have been asked to bring to your attention by a committee representing public utility interests.

These papers indicate the existence of genuine apprehension regarding the adequacy, under present conditions, of the services and rates of local public utilities. The view is expressed that increased wages and the high cost of essential materials and supplies have affected them as they have affected everybody else, and that united effort will be necessary in order to meet alike the public requirements for service and the corporate financial needs upon which that service depends.

As Secretary of the Treasury I must take official notice of these matters. It is obvious that every part of our industrial and economic life should be maintained at its maximum strength in order that each may contribute in the fullest measure to the vigorous prosecution of the war. Our local public utilities must not be permitted to become weakened. The transportation of workers to and from our vital industries and the health and comfort of our citizens in their homes are dependent upon them, and the necessary power to drive many of our war industries and many other industries essential to the war is produced by them. It may be that here and there, because of the prominence given to less important interests immediately at hand, state and local authorities do not always appreciate the close connection between the soundness and efficiency of these local utilities and the national strength and vigor and do not resort with sufficient promptness to the call for remedial measures. In such cases I am confident that all such state and local authorities will respond promptly to the national needs when the matter is fairly and properly brought before them.

Our public service utilities are closely connected with and are an essential part of our preparations for and successful prosecution of the war, and the unfavorable tendencies which the accompanying papers reveal may most effectively be checked, wherever they may be found to exist, and the needed relief obtained, only by prompt action on the part of the respective local authorities.

I earnestly hope that you may feel justified in expressing the conviction that the vital part which the public utilities companies represent in the life and war-making energy of the nation ought to receive fair and just recognition by state and local authorities. Cordially yours,

W. G. McADOO.

The President, the White House.

THE PRESIDENT'S REPLY

THE WHITE HOUSE, WASHINGTON,

February 19, 1918.

MY DEAR MR. SECRETARY:

I have examined with care the memoranda and letters which you transmitted to me with your letter of the fifteenth. I fully share the views you express regarding the importance of the public service utilities as a part of our national equipment, especially in war time. It is essential that these utilities should be maintained at their maximum efficiency and that everything reasonably possible should be done with that end in view. I hope that state and local authorities, where they have not already done so, will, when the facts are properly laid before them, respond promptly to the necessities of the situation.

I shall be glad to have you communicate with the local authorities whenever the information in your possession suggests that such a course is desirable and in the national interests. Cordially yours,

WOODROW WILSON.

Hon. William G. McAdoo, Secretary of the Treasury.

securities, either public utility, municipal, state or otherwise, for non-essentials. It will be the policy of the government to mobilize all money, labor and materials for the successful prosecution of the war and eliminate for the period of the war non-essential expenditures. When this policy is finally put into effect through the enactment of the war finance bill, it should mean that the companies will be relieved of non-essential expenditures, such as unnecessary paving, undergrounding of wires, etc.

As to the matter of financing maturing obligations and extensions and improvements necessitated by the war program, provision is made for this in the war finance bill, Senate No. 3714, reported on Feb. 21 by the Senate committee on finance. The latter committee gave your committee a hearing and has inserted in the bill a clause designed to cover the needs of public utilities as follows:

"(D) To make advances directly (1) to any corporation owning or controlling (directly or through stock ownership) any railroad or other public utility, and (2) to any firm, corporation or association conducting an established and going business whose operations are necessary or contributory to the prosecution of the war; provided that such advances shall be made only in such cases as the board of directors in its discretion shall determine to be of exceptional importance in the public interest. Such advances may be made for periods not exceeding five years from the passage of this act, upon such terms and upon such security and subject to such rules and regulations as may be prescribed from time to time by the board of directors of the corporation, with the approval of the Secretary of the Treasury. The corporation shall have and retain power to acquire additional security from time to time."

The outlook for the public utilities, decidedly more encouraging than it was two months ago, may be summarized as follows:

1. In the matter of rates the President of the United States, the Secretary of the Treasury and the Comptroller of the Currency have officially recognized that it is in the public interest that public utilities be maintained at their maximum efficiency and their rates be adjusted to meet the increased costs of doing business.

2. The national government, through the capital issues committee, has outlined a national policy seeking to discourage unnecessary employment of money, labor and materials during the period of the war.

3. The war finance bill, now on its passage, makes provision for financing the maturing obligations of public utilities and provides a method for financing necessary extensions and enlargements.

The utility associations are issuing a bulletin containing the letters of the President, the Secretary of the Treasury and the Comptroller of the Currency. In conclusion the committee says in its report:

We recommend that the national associations also take steps to present this general matter to the commissions in the different states as a national question, entirely disassociated from any concrete local question of rate increases for any particular company. Until the general situation has been taken up in this way with the various state commissions, we suggest that you urge your members not to formally submit to the commissions the President's and the other letters, except in instances where they are immediately necessary in pending cases.

We recommend that you arrange to furnish your members with as many copies of the bulletin containing these letters as they may require, and that they be distributed generally among the officers and employees of the various companies.

You will notice that the last sentence in the President's letter to the Secretary reads as follows: "I shall be glad to have you communicate with the local authorities whenever the information in your possession suggests that such a course is desirable and in the national interests."

Your committee calls attention to the fact that the authorities in Washington are already overburdened with tremendous and overwhelming responsibilities, and suggests that under the circumstances members should appeal to Washington only in cases of imperative necessity, and then only after first consulting with their own secretaries.

WASHINGTON TELEPHONE CASE BRINGS UP PUBLIC OWNERSHIP

Postmaster General Burleson Offers to Take Over Control and Operation of the Chesapeake & Potomac Telephone Company During War

Postmaster General Burleson, through Washington city post office officials, has offered to the Public Utilities Commission of the District of Columbia to take over the control and operation of the Chesapeake & Potomac Telephone Company in and around Washington for the period of the war, agreeing, if the offer is accepted, to maintain present standards of pay to telephone employees and guarantee to investors the present rate of return on their holdings.

It is believed in Washington that under present District of Columbia laws creating the Public Utilities Commission and outlining its powers and duties the commission has no power to accept such an offer, although it is well understood that the President of the United States, under the blanket war powers granted him by Congress, could issue an executive order making it possible for the commission to accept such an offer if he deemed it wise to do so. Without such an order it is believed that it is not possible for the commission to accept such an offer except by consent of the telephone company. Officials of the company in Washington decline to discuss the offer.

NECESSARY STEPS TO PUT OUT SECURITIES

Capital Issues Committee of Federal Reserve Board Shows What Should Be Done to Get Its Formal Sanction

As stated in the last issue of the ELECTRICAL WORLD, approval has already been given by the capital issues committee of the Federal Reserve Board to the issue of securities by some electric utilities. The capital issues committee has now made public instructions with respect to proposed issues of bonds, notes, shares of stock, etc., in part as follows:

Applications should be addressed to the capital issues committee, 718 Metropolitan Bank Building, Washington.

If the purpose is to refund, fund or pay or extend outstanding bonds, obligations or indebtedness, describe fully the nature and character of bonds, etc., to be refunded and state briefly the time or times and the general purposes for which unsecured indebtedness was incurred.

If the issue is to be made for war purposes or to raise capital in connection with war contracts or war supplies, or to provide equipment, buildings or facilities of any kind for war work, full description thereof and amounts needed therefor should be stated.

If any war purposes are involved, reference should be made to the proper governmental authorities at Washington and elsewhere to enable definite information and corroboration to be obtained directly by the committee.

If the issue is deemed necessary on account of any governmental requirement, national, state or municipal, or of any commission or public authority, describe the same in full.

If the issue is deemed necessary for reasons of public health or welfare or other public economic necessity, describe the same in full.

If the issue is made for private financial requirements and no public interests are involved, a very clear exposition of necessity will be desired.

In all cases full reasons should be given why the proposed issues cannot be postponed until after the war.

MUSCLE SHOALS DAM TO BE CONSTRUCTED

President Authorizes Huge Hydroelectric Project on Tennessee River as Part of New Government Nitrate Plant

President Wilson signed an order on Feb. 25 authorizing the construction of the largest of the dams on the Tennessee River projected some years ago as the Muscle Shoals hydroelectric development.

The construction is to be carried out with funds derived from the appropriation for a government nitrate plant which was made by Congress in 1916, and the hydroelectric plant when completed will become a part of the two nitrate plants now being built near Muscle Shoals at Sheffield, Ala.

These two plants are (1) a factory for the fixation of nitrogen which will produce approximately 20,000 tons of ammonium nitrate a year and will be owned and operated by the United States and (2) a plant owned by the United States but operated by the Air Nitrates Corporation, which will produce 110,000 tons of ammonium nitrate a year.

Electricity used in the operation of these plants will be generated by steam power and will be brought from distant hydroelectric plants for initial operation, but will eventually be produced at Muscle Shoals.

FIXTURE ASSOCIATION HOLDS SECOND ANNUAL CONVENTION

St. Louis Meeting Discusses Advisability of Joining Contractor-Dealers' Association—C. J. Netting, Detroit, Elected President

The feature of the second annual convention of the Lighting Fixture Dealers' Society of America, at the Statler Hotel, St. Louis, on Feb. 15 and 16, was a discussion on the advisability of affiliation by that organization with the National Association of Electrical Contractors and Dealers.

The discussion brought out that the opinion of the fixture association is divided on this point, one faction feeling that the organization should join with the contractor-dealers, and the other that the fixture business is not really an electrical business, but is more of an art dealers' business. The outcome of the discussion was a decision to appoint a committee to consider whether or not the fixture association should affiliate with the contractor-dealers. This committee is to report not later than the June meeting of the National Association of Electrical Contractors and Dealers. Frank Adam of St. Louis had been authorized by the National Association of Contractors and Dealers to issue an invitation to the lighting fixture society to affiliate with the contractor-dealers.

George H. Barnes, Detroit, presented before the association an able paper containing a considerable amount of tabulated data on the cost of handling glass used in the lighting-fixture business. The association gave the executive committee authority to hire an organizer and secretary. J. Callahan, Detroit, was selected.

The following officers were elected: President, C. J. Netting, C. J. Netting Company, Detroit; vice-president, A. L. Oppenheimer, Enterprise Electric Fixture Company, Cleveland; secretary, J. A. Hamilton, Hamilton-Stotter Company, Cleveland; treasurer, H. E. Pauley, Wallbridge & Co., Buffalo; executive committee: W. L. Burgess, Burgess & Ganden Company, Omaha; E. L. Gress, Gress Chandelier Company, St. Louis; Albert Jacobson, Kansas City (Mo.) Chandelier Company; George H. Barnes, George H. Barnes Company, Detroit.

ASSOCIATED MANUFACTURERS WORK ON INTERNATIONAL TRADE

At New York Meeting Further Progress Is Made in the Consideration of Tariff Matters Affecting the Electrical Manufacturers

A meeting of the international trade committee of the Associated Manufacturers of Electrical Supplies was held at the offices of the association, New York, on Feb. 14. John J. Gibson, the chairman, presided.

Mr. Gibson stated that since the last meeting of the committee the board of governors had taken action to broaden the duties of the committee so that they would include questions in regard to export as well as import and that the name had been changed from tariff committee to international trade committee.

The chairman reported the results of a visit which he had made to the United States Tariff Commission offices in Washington. Commissioner W. S. Culbertson outlined to the chairman the plans of the commission.

Commissioner Culbertson suggested that in the near future a conference might be held between the commission and representative electrical manufacturers.

Mr. Gibson said that he had discussed with Commissioner Culbertson the advisability of employment by the association of a tariff expert. Commissioner Culbertson expressed the belief that such a plan would provide the surest and quickest way of accomplishing the object sought.

Attention was called to section 704 of the act of 1917 creating the Tariff Commission, which reads:

> That the commission shall have power to investigate the tariff relations between the United States and foreign countries, commercial treaties, preferential provisions, economic alliances, the effect of export bounties and preferential transportation rates, the volume of importations compared with domestic production and consumption, and conditions, causes and effects relating to competition of foreign industries with those of the United States, including dumping and cost of production.

This section practically covers the newly added duties of this international trade committee. It practically indicates that the work of the committee is parallel, so far as the electrical industry is concerned, with the work of the United States Tariff Commission.

L. Livingston brought up the question of the customs administrative laws and read a digest which he personally had made with respect to certain divisions of the present law and to the suggested revision thereof. A similar digest, made by William C. Burgess, Trenton, N. J. (which was forwarded to the chairman by B. E. Salisbury, of Pass & Seymour, Inc.), was read.

Copies of the digests of the customs administrative laws, prepared by Messrs. Livingston and Burgess, will be sent to members of the board of governors and of the international trade committee and to chairmen and members of the section sub-committees on international trade.

COMMONWEALTH EDISON RESULTS FOR THE YEAR

Operating Revenue for 1917 Reaches $25,350,000—Operations Conducted Without Increase in Rates, Notwithstanding Higher Costs

Operating revenue of the Commonwealth Edison Company for the year ended Dec. 31, 1917, was $25,351,585, an increase of $2,488,467, or 10.9 per cent, over the previous fiscal year.

Net operating revenue for 1917 amounted to $8,723,702, as compared with $8,133,073 in 1916. The net for the stock was $4,677,077, or 10.21 per cent on the company's capital stock, as compared with $4,399,413, or 9.6 per cent on the stock, for the previous year. Earnings and expenses for the year were:

Operating revenue		$25,351,585.35
Operating expenses	$13,791,636.29	
Appropriated for amortization and depreciation reserve	2,836,246.41	16,627,882.70
Net operating revenue		$8,723,702.65
Taxes and municipal compensation		2,229,906.74
Operating income		$6,493,795.91
Other income		314,831.27
Total income		$6,808,627.18
Less interest on bonds		2,131,550.00
Available for dividends		$4,677,077.18
Dividends paid		3,667,352.00
Balance carried to surplus		$1,009,725.18

President Samuel Insull speaks in the report of the successful operation without increased rates in spite of higher costs. He also discusses the advantage of ownership of coal mines by the company, whose general coal policy enabled it to provide fuel for domestic consumption at critical periods. Mr. Insull's comments follow in part:

There has been charged against taxes and correspondingly credited to taxes accrued an amount deemed sufficient to cover 1917 municipal, state and federal taxes with the exception of war excess profits taxes. This amount will take care of the increase in the income tax, the rate of which has been increased from 2 per cent to 6 per cent on the earnings of the company before payment of dividends.

While the Treasury Department officials have furnished some information and rulings regarding the war excess profits taxes, they have not yet issued the necessary forms on which the taxes are to be calculated and reported to the Treasury Department, and still further rulings are to be expected.

As therefore more or less doubt now exists as to the exact requirements to be followed in making up the report of excess profits, the company considers it inadvisable to attempt any estimate in the matter, but prefers to wait until it is in position to file the official figures and then whatever amount may be found to be payable will be charged against the company's surplus.

In view of the great increases which have taken place during the past year in the cost of labor and materials as a result of the war, without any increase in rates charged, the board feels that the company may justifiably congratulate itself upon the showing it is able to make.

During the past year the company has derived much benefit from its virtual ownership of its own coal mines, both as to cost and as to its ability to secure coal when needed. During the coming year the company expects further to increase its use of coal obtained from its own mines.

It has been the practice of the company during past years to carry a substantial amount of coal in storage to guard against possible fuel shortage from any unforeseen cause. At the beginning of the winter the company had in storage approximately 425,000 tons, being largely coal produced at its own mines. The policy pursued has enabled the company to carry on uninterrupted operation of its plants during the period of fuel stress with much less demand on general market supplies than usual. In addition it has been enabled during the most acute periods of the coal famine to help the community by placing at the disposal of the local federal Fuel Administrator substantial amounts of coal for general domestic consumption.

As partially set forth in the report for last year, 10 per cent of additional stock was offered to stockholders, for which quarterly payments were required on the first days of February, May, August and November, 1917. Stock certificates were issued on the latter date, thereby bringing up the total capitalization to $50,422,826. The proceeds from the sale of this stock provided for additional plant capacity to take care of the increasing business. Owing to the high cost of labor and material, and to the patriotic duty which rests upon all corporations and individuals to conserve capital as well as other commodities while the war lasts, it will be the policy of the company during the year 1918 to curtail as far as possible all extensions of its plants and lines, and it therefore does not contemplate during the coming year any further issues of stock or bonds.

During the year 633 employees of the company entered the service of the United States government, being approximately 13½ per cent of the total number of men in the service of the company. The company can be proud of having so large a proportion of its employees in war service.

During the year approximately 31,000 new customers have been added, thus making at present a total of 351,700 customers. This represents an increase of 97,000 kw. in connected load.

The highest maximum load recorded at any one time during the year was 392,330 kw., which is an increase of 6 per cent over the highest load recorded during the previous year.

The company's connected business (exclusive of electrical energy supplied to other public service corporations) amounted to the equivalent of 15,336,791 50-watt lamps on Dec. 31, 1917.

ILLUMINATING ENGINEERING SOCIETY MEETS AT CHICAGO

M. Luckiesh States that Variety in Home Lighting Is a Necessity and Should Be Thoroughly Studied

In an address on "The Lighting Art" before the Illuminating Engineering Society, Chicago, on Feb. 21, M. Luckiesh told of the possibilities in home lighting. Fifty per cent of all lighting, he said, is used in the home and the householder does not appreciate that lighting will make the home more beautiful and a better place in which to live. Light is a medium that is real as pigment, continued the speaker. It may be used for decorative purposes by spraying light to get shade effects and is as effective and pleasing to the eye as any so-called decorations.

The subject of home lighting can be divided into two classes, namely, lighting that deals in facts and lighting that deals with fancy.

The following points showing why and how home lighting should be bettered were brought out by the speaker:

A necessity for variety of lighting, because every one demands variety.

Architects can increase use of light by specifying a greater number of outlets.

The electrical contractor can help by not decreasing the number of outlets specified, in order to reduce the cost.

The fixture manufacturers should co-ordinate art and science in design. Mr. Luckiesh stated that only 1 per cent of lighting fixtures now made combine the two ideal

principles. The fixture should be designed first for science and should then be dressed to give a good appearance.

The fixture dealer should arrange his store so that careful inspection can be obtained. The display room is usually a shower of fixtures arranged for economy of space rather than for artistic purposes.

The lamp manufacturers should put on the market lamps of different tints, tints that are light enough to be felt and not seen.

The fixtures should be so arranged that several sets of lights and shades could be obtained to fit in with the mood of a person at different times.

The decorator should make the walls of a neutral color so that the effects of the different tints can be obtained.

A number of slides were shown that gave the effect of tints of lights by shading the slides with different colors. An ideal dining-room fixture was shown which embodied several new features of fixture design.

"ELECTRIC FURNACES" DISCUSSED AT CHICAGO

Joint Meeting of Chicago Section of American Institute of Electrical Engineers and Western Society of Engineers

"Electric Furnaces" was the topic of discussion at a joint meeting of the Chicago Section of the American Institute of Electrical Engineers and the Western Society of Engineers at Chicago on Feb. 25. The members of the Heat Treatment Club—a local body of steel engineers—had also been invited as guests of the engineering societies. The papers of the evening were presented by Thaddeus Bailey, president of the Electric Furnace Company of Alliance, Ohio, and John A. Seede, General Electric Company.

Mr. Bailey's paper was a discussion of the development of resistance-type furnaces of large capacity for operation at temperatures between 400 deg. and 1200 deg. Fahr. The paper brought out the tendency in furnaces of this type toward automatic operation and toward the use of the recuperative principle for making use of heat stored in the metal under treatment. Car-type furnaces taking as much as 600 kw. were illustrated and it was stated that a melting type of furnace now in course of construction for a Western zinc-smelting plant will take 1000 kw.

Annealing and heat-treating furnaces of the resistance type, the author stated, had met with favor more on account of the precision with which heat-treating operations can be conducted than on account of saving in cost over fuel-fired furnaces. In some cases a considerable saving has resulted over other methods, especially in the automatic furnaces, where the labor charge was greatly reduced. In other cases effecting a reduction in the number of imperfect pieces of work also made large savings.

In handling brass, however, these furnaces have without exception shown large savings over crucible or open-flame types, no matter how they were fired. The electric furnaces in handling brass will usually show a zinc saving of from 3 to 4 per cent over the open-flame type and a 2 per cent zinc saving over the crucible type. In the latter, however, the crucible costs are so high that an electric furnace will usually pay for itself in from three to four months even with electricity at 2 cents per kilowatt-hour. Moreover, the furnaces are of direct economic value, as they not only save money but also save metal that would be lost forever if it were allowed to pass off in fumes.

Typical weekly running sheets shown by Mr. Bailey indicated that a 105-kw. tilting-type furnace making brass cartridge-case slabs could be operated on an average of 340 kw.-hr. per ton, including the heating-up losses.

Mr. Seede showed lantern slides following through the history of the development of the several types of arc furnaces. He spoke strongly for automatic control of arc furnaces, arguing the necessity for quicker action than human minds and hands can give. He also mentioned a new arc furnace installation which is to be operated at temperatures as high as 3300 deg.

The two papers were discussed by C. F. Bussy, Hoskins Furnace Company; J. Gardner, Illinois Steel Company; Douglas Walker, Booth-Hall Company; H. M. St. John, Commonwealth Edison Company; Alfred Hertz, Public Service Company of Northern Illinois; G. D. Hart, National Malleable Castings Company, and C. W. Pendll, Public Service Company of Northern Illinois.

Mr. Gardner stated that the two 15-ton and two 30-ton furnaces of the Illinois Steel Company were operating continuously and were giving no trouble. For the larger furnaces automatic control is very desirable, especially in the manufacture of gun steel and other products of superior grade.

OHIO TRANSMISSION AND DISTRIBUTION PEOPLE MEET

Cincinnati Conference Is Attended by Fifty Representatives from Ohio, Kentucky and Indiana Companies and Arouses Great Interest

The conference of the transmission and distribution committee of the Ohio Electric Light Association at the Hotel Gibson, Cincinnati, on Feb. 21, was the most successful meeting ever held by that organization. Fifty central-station men from Ohio, Kentucky and Indiana companies attended. All of the papers were enthusiastically received and brought forth a good amount of discussion.

A paper on "Shall Transformers Be Banked in a Distribution System?" by M. E. Grah, Toledo Railways & Light Company, discussed the transformer spacing, the percentage of rated load for which the primaries should be fused, whether or not the secondaries should be fused to prevent overload on any one bank of transformers, and what size this fuse should be. The paper contained data helpful in handling these problems.

E. D. Monk, Cincinnati office of the General Electric Company, presented a paper on standardization of transformers, pointing out the trend of the work of the National Electric Light Association, the Electric Power Club and of his company toward the establishment of standards in transformers.

A paper on cut-out problems by C. A. Harrington, Mahoning & Shenango Railway & Light Company, Youngstown, outlined definitely what the operating companies desire a cut-out to do.

The papers were discussed by W. E. Beatty, Cincinnati; G. M. Miller, Louisville; B. L. Chase, Columbus; I. L. Rankin, Chicago; J. W. Bryant, Cincinnati; M. H. Wagner, Dayton; F. R. Healy, Cincinnati, and Messrs. Conrad and Snyder.

Lack of Coal Stops Power in New Jersey

Active Industrial District in Northern Part of State Paralyzed by Inability of Company and Authorities to Get Coal

POWER shortage, due to coal shortage, is now a vital issue in the populous industrial district of northern New Jersey, crowded with manufacturing plants making war materials. Power has been shut off, stopping industries abruptly, because the necessary coal was unobtainable.

The Public Service Electric Company of Newark, supplying this busy district, is on such short rations that its entire service has been in almost constant peril. It has been obliged to stop service on various occasions, with the immediate result that industrial plants discontinued operation and the accompanying result that thousands of men were thrown out of work and production of essential war materials was delayed.

The district in which this situation has developed is not remote from railroad service, it is not far distant from mines abundant with coal. The generating stations of the Public Service Electric Company are accessible by both rail and water; the northern New Jersey district is a grillwork of railroads. Great coal-carrying systems—the Pennsylvania, Reading, Lackawanna, Erie, Lehigh Valley, Baltimore & Ohio, and Central Railroad of New Jersey—stretch their lines thickly through this region.

The story of the inability of the Public Service Electric Company to give continuous service to its thousands of industrial consumers is simply a story of coal shortage. It is a recital of facts that can be found in lesser degree in many central-station properties in different parts of the country, but which are intensified and revealed to public gaze by the extreme degree to which they developed in this case.

Here is a property with new stations, well equipped with thoroughly modern generating apparatus and distribution systems to meet the normal demands upon it. It is not a case of a company which has had to abandon the performance of its public duty because its system was inadequate to meet the load, or because its equipment was obsolete. Under broad policies of construction and co-ordination efficient stations had been created to meet the expanding business which was foreseen.

Yet the company, the Washington authorities and the New Jersey representatives of the Fuel Administration, individually and collectively, have been unable to provide the coal supply for the boilers which alone would have kept the vast industrial resources of the northern part of the State actively mobilized for war.

In its efforts to get coal the company has had a representative at Washington continuously. Many official and unofficial investigations have been made in an endeavor to accelerate relief.

One unofficial investigation of this character followed an acute condition of shortage as a result of which the company shut off about 50 per cent of the power usually furnished to consumers. The majority of the customers affected were commercial-power consumers. They included practically all of the large industries engaged in manufacturing war munitions or in other work incident to the war. A slight curtailment of service on the lines of the affiliated Public Service Railway was also found necessary at that time. Since Jan. 1 the company has been dependent largely on the Shipping Board for fuel, but when this shutdown was enforced that board was unable to provide a supply. The small amount of coal received by the company from the mines had supplemented the other source of supply, and assisted in keeping the plants in operation. The total supply found at various generating stations was very small compared with the normal daily requirements.

HEARING BEFORE NEW JERSEY COMMISSION

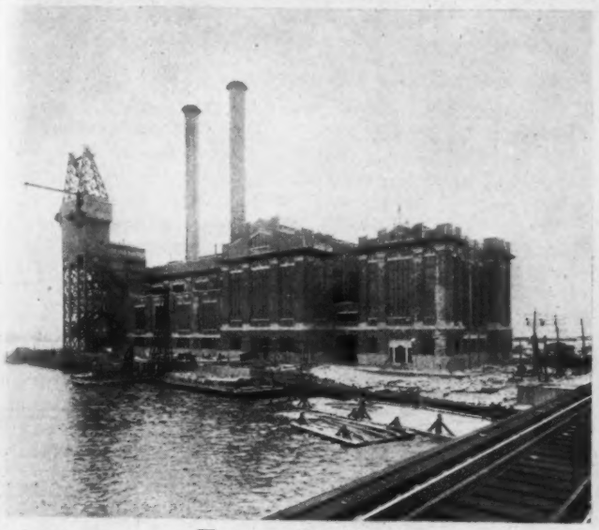
At a hearing before the New Jersey Board of Public Utility Commissioners Thomas N. McCarter, president of the company, testified at length regarding the difficulties confronting the company.

The coal situation of the Public Service Electric Company has been acute for nearly a year, said Mr. McCarter. The company has a contract for coal for its electric plants with the Barnes & Tucker Coal Company, a large concern in the Pennsylvania coal field having several mines, for the exclusive output of four of its mines. The average tonnage, worked to capacity, of those four mines would give the company, if delivered, 900,000 tons of coal during the year beginning in March or April, 1917. The requirements for coal at that time were between 700,000 and 800,000 tons.

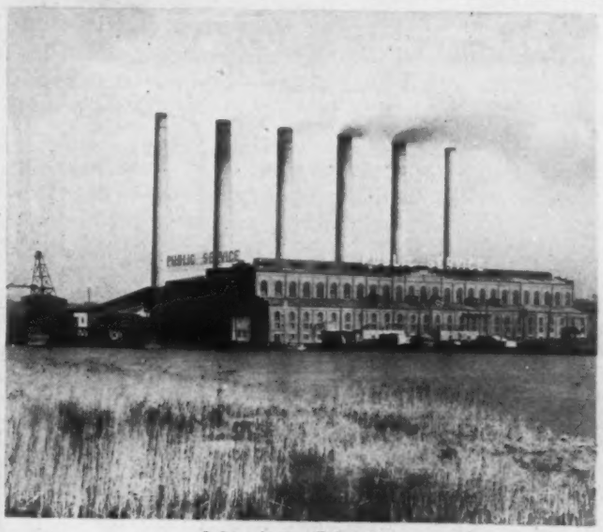
Not wishing to rely on that contract altogether, or have all the eggs in one basket, the company made other contracts with different coal contractors for lesser but still very substantial amounts, running to 100,000 or 200,000 tons apiece. Had the coal contracted for been delivered there would have been no trouble.

About a year ago, when the transportation difficulties began to be acute, Mr. McCarter went to Washington, accompanied by J. A. Pearson, purchasing agent of the company. They went to the Interstate Commerce Commission and then to the Railroad War Board. The latter board agreed to see that railroad cars were put into the Barnes & Tucker mine sufficient to carry to the company all the coal that those mines could mine. This was done, said Mr. McCarter, until it developed that there were mine troubles as well as transportation troubles. The coal miners are very largely foreigners from southeastern Europe. They are very independent. They are making, in most cases, larger wages than they have been in the habit of making, and hence are a little more independent as to the number of days in the week they work, their necessities being met by the advanced wages. The result was that it became impossible for the Barnes & Tucker company—and, as far as Mr. McCarter knows, any other coal miners in that district—to mine their full quota of coal during the year. The witness said that he thought that the Barnes & Tucker company had done its best, and he was sure the railroads had done their best in putting cars into the mines.

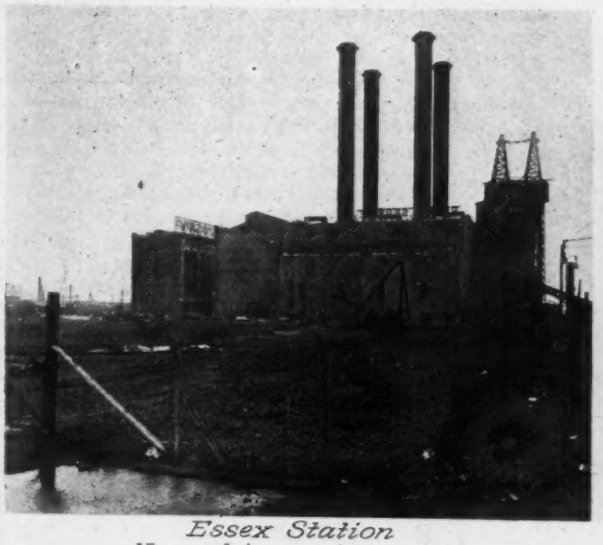
In the summer the Federal Trade Commission in Washington, acting in co-operation with Secretary Lane,



Essex Station



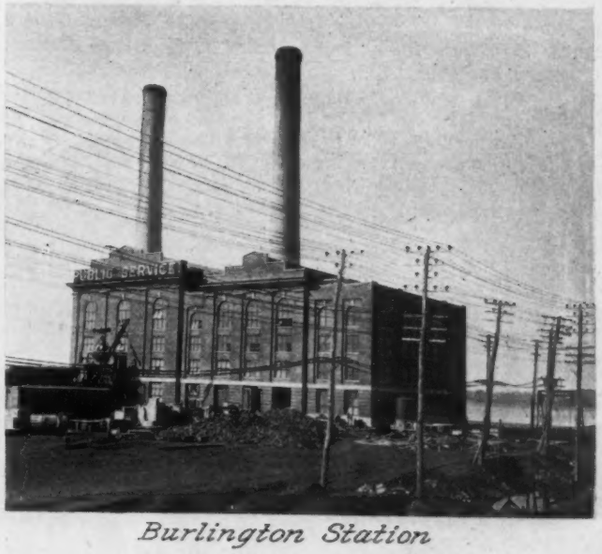
Marion Station



Essex Station
No coal in yard storage
Usually full of coal

Marion Station
No coal in yard storage. These black piles are ashes to be loaded on cars for removal. Usually this space is full of coal.

Perth Amboy Station



Burlington Station

MODERN PLANTS KEPT INACTIVE BY LACK OF COAL

fixed the price of coal at $3 per ton at the mines. This price did not meet with the approval of certain other departments, notably the War Department, and that arrangement, which Mr. McCarter thinks would have been satisfactory to the miners and would have produced a far larger quantity of mined coal at that time, was upset and a subsequent price of $2 or thereabouts was made. That has since been raised. Mr. McCarter added:

In this period a large amount of coal that was mined was shipped away from the United States to Canada by the coal operatives. We were endeavoring all this period of the summer to store coal, not only to get coal enough for our daily needs, but to store coal for the present day, foreseeing, as every operator of these properties does, that his winter season is the busy season, and the difficulties of coal transportation in winter are increased; but the most we could accumulate during the summer, owing to the causes which I have tried to outline, was 100,000 tons of coal, when the order came fixing the price at $2.

We had opportunities to buy coal after that at varying prices named by coal men, which we declined to do because we believed it our patriotic duty to obey the mandate of the government and, inferentially, we didn't care to go to prison for not obeying. It was a state's prison offense to buy coal at the excess price as much as it was to sell it at the excess price. Some people did buy and sell coal at the higher prices, and we didn't.

The situation has been further complicated by the troubles of the winter. Some of our coal, some of our Barnes & Tucker coal, has been taken away from us by government mandate and sent to departments in Washington and forwarded to the Shipping Board. Many orders of that kind have been made, some of which we have succeeded in having canceled. About a month or six weeks ago I spent the major portion of the afternoon with Dr. Garfield in Washington, whom I have known many years, and he went over the whole situation thoroughly with me. He told me that the situation was very acute, but his last word to me was:

"Mr. McCarter, you will be taken care of. We cannot allow the Public Service to get out of coal."

He has been unable to keep that promise. I don't blame him for it. I don't know that anybody else would have done any better, but I simply state the fact.

Answering an inquiry as to the cause of the failure, whether lack of mining coal, transportation troubles or diversions, or all three, Mr. McCarter said:

I think it was due to them all, made acute by the severity of the winter and the transportation troubles that have taken place more recently. Owing to the weather conditions, our Barnes & Tucker and other coal began to fail us even to the extent we had been getting it. The Fuel Administration made every effort to help us. For the last three or four weeks since the earlier shutdown it had been keeping us going from day to day by diverting to our use coal in the tidewater pool consigned to other people, in some cases taking it away from ships in the harbor and in other cases taking it from other consignees; in all events, getting to us about the quantity we were failing to get owing to the other troubles.

On Saturday of last week, out of a clear sky, the Fuel Administration notified us that it would be unable to continue giving coal to us any longer, for two reasons—because it practically had no coal in the coal pool, and what it did have it was under peremptory orders from Washington to give to the ships in the harbor.

This found us with a mere pittance of coal for such a property as ours, and there seemed to be nothing to do but to notify the public of the necessity for the immediate shutdown, having enough coal in our bunkers to keep reasonable lighting going, and such power as to keep the elevator power in operation and a limited number of cars on the street, besides a small amount of power being used by the Shipping Board at Port Newark Terminal. I am speaking now of the northern section of the State. There is no shutdown in power, at the moment, in what is known as the Southern Division, from Trenton south, where we are going on from hand to mouth, from day to day; but the shutdown I refer to is in the other division, embracing the northern section of the State.

The hearing then proceeded along the following lines:

Commissioner Donges asked: "Is there any governmental agency, as far as you know, which could do anything to relieve the situation, or which is diverting coal to any other properties which ought to come to the Public Service, or are they, as far as you know, all being treated alike?"

The witness replied: "I think the Fuel Board—the Fuel Board has a great big job; it is being managed by a great many different men, as heads of departments, and I think they are treading on each other's toes. It seems to me foolish (and yet I don't like to criticise; we don't know all their burdens)—it seems to me Washington is straining every nerve to get coal to us and then stealing 100 tons of our coal from Tucker for somebody else. That is constantly going on. It does not seem to me in the Fuel Department there is very much co-ordination. I say it with a great deal of deference, and I have been considerate in the extreme of the whole question."

Commissioner Donges: "What I meant was whether, compared with what other industries were getting, you were getting your share."

Witness: "I think we are, and perhaps more."

Commissioner Donges: "That is what I had in mind."

Witness: "That is all. Shall I proceed?"

Commissioner Donges: "Yes."

Witness: "I am glad to have the opportunity of stating to the commission, and in the presence of these people, the facts I have stated. It is very annoying and distressing to all power manufacturers by reason of it."

Mr. King: "You made a remark to the effect that you hoped you would not have to keep closed down after you had accumulated a stock of coal, just now. Is it your thought that you will keep shut down until you accumulate a stock of coal?"

Witness: "Not any great stock. I don't like intermittent shutdowns, from one day to another. I thought if we stayed down a week more or less now we could accumulate more coal than we have had for the last two months, and with the breaking up of the winter, as we have had, we would be better off than by starting up the very first day and then perhaps shutting down the second day. But we are open to persuasion about that. Perhaps our view is wrong."

As indicated by the remarks of Mr. McCarter, the situation is beyond the control of the company. As this issue goes to press the company has succeeded in getting enough coal to resume full operation of its plants, although it is still moving on a day-to-day coal supply.

ELECTRICAL MEN PUSH WAR SAVINGS STAMPS

Committee of New York Apparatus and Supply Men Report that About 75 per Cent of "Prospects" Have Agencies

Considerable interest is being shown in New York electrical circles in the distribution and sale of war savings stamps. An electrical apparatus and supply division of the National War Savings Committee has been appointed for the greater city of New York, with offices at 195 Broadway.

The division committee, under the chairmanship of H. A. Halligan, vice-president of the Western Electric Company, is composed of R. Edwards, H. T. Hockhausen, M. A. Oberlander, G. L. Patterson, E. W. Rockafellow, C. P. Scott, P. L. Thomson and J. M. Wakeman. A. E. Beling is secretary.

M. A. Oberlander, who is campaign manager, states that about 75 per cent of the "prospects" have been induced to take out agencies for the sale of stamps.

Associations and Societies

The Directory of Electrical Associations, which is regularly printed in the first issue of each month, appears on page 495 of this number.

Los Angeles Synchronous Club.—Lecture No. 9 of the Synchronous Course on "Steam, Gas and Oil Engines" was given at the Feb. 21 meeting by J. W. Andree, department of generation, Southern California Edison Company.

St. Louis Jovian League.—In his address before the St. Louis Jovian League Feb. 19 Major John R. Fordyce, Engineers' Reserve Corps, constructing quartermaster in charge of the building of Camp Pike near Little Rock, Ark., showed conclusively the efficiency and dispatch with which the work was completed.

New York Electrical Society.—On Feb. 26 Major Frederick Palmer, Intelligence Section, on General Pershing's staff, presented a paper on "Our Army in France." Capt. Alexander Macomber spoke on "The Searchlight Regiment, the Fifty-sixth," and Major A. B. Kratz spoke on "The Electrical Regiment, the Thirty-seventh." This meeting was the society's thirty-seventh anniversary and its eleventh war meeting.

San Francisco Electrical Development League.—At a meeting of this association on Feb. 13 a new constitution was adopted and the name of the organization was changed from the San Francisco Electrical Development and Jovian League to the San Francisco Electrical Development League. The new constitution is so drafted as to make the organization entirely independent of any other and provision is made for developing it along broad lines. New officers elected for a term of one year, beginning March 1, are as follows: President, R. E. Fisher; first vice-president, H. C. Reid; second vice-president, H. P. Pitts, and new members of the executive committee, F. J. Bennett and Frank Roeber.

Minnesota Electrical Association.—The annual convention of the Minnesota Electrical Association will be held at the Hotel Radisson, Minneapolis, March 11, 12 and 13. In a statement issued by the officers and board of directors of the association concerning the convention it was stated that members are showing lively interest in it. The increasing difficulty of central-station problems makes especially timely all the advice and assistance that it is possible to get through an interchange of ideas. Among the important papers to be presented are "Minnesota Water Powers," by R. J. Thomas, superintendent of the St. Anthony Falls Water Power Company, and "Iron-Wire Transmission Lines," by Prof. W. T. Ryan of the University of Minnesota. H. E. Young of the Minneapolis General Electric Company is secretary-treasurer of the association.

Inter-Section Meeting of the A. I. E. E. and the A. I. S. E. E.—The three hundred and thirty-eighth meeting of the A. I. E. E., which will be held at Cleveland, March 8, is an inter-section meeting in which the Cleveland, Pittsburgh, Toledo, Toronto and Detroit sections of the Institute will participate. This meeting will be held in conjunction with the Association of Iron and Steel Electrical Engineers. The morning session will include a paper by George J. Newton on "Design of Underground Distribution for Electric Light and Power," and a paper by Robert F. Hamilton on "Some Considerations in Determining the Capacity of Rolling-Mill Motors." At the evening session J. D. Wright will present a paper on "Selection of Steel-Mill Auxiliary Motors and Control as Affected by Mechanical Features of the Drive," and the standardization committee of the A. I. S. E. E. one on "Steel Industry Motors Standardizing."

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Sales of Electrical Energy in New York.—The report made by the New York Public Service Commission, First District, to the Legislature says: "The most recent statistics for gas and electric companies are for the calendar year 1916. In that year gas companies in New York City manufactured and sold 44,565,753,000 cu. ft., an increase of 4.76 per cent. Sales of electricity, however, showed a very much higher percentage of increase, the enlarged use being accounted for in great part by the material reductions in Manhattan, the Bronx and Brooklyn. Increase in population was also partly responsible. Electric companies sold to the public 846,201,369 kw.-hr. and received therefor $38,687,806, an increase of 16.40 per cent. Consumers numbered 360,669, against 306,217 in 1915. Gas sales were about $6.61 per capita and electric about $7.03 per capita."

Large Demand for Additional Service.—In its annual report to stockholders for the year ended Dec. 31, 1917, the Continental Gas & Electric Corporation, Cleveland, says in part: "Costs of coal, oil, labor and material reached during 1917 what is felt to be their peak and it follows therefore that the net earnings of your company for the past year are less than its normal earning capacity. Coupled with this is the fact that no advances were made in rates to consumers, so that in a year of average material costs net earnings on the common stock would have been approximately 8 per cent greater. Steps have already been taken to advance rates of the subsidiary companies 20 per cent. Profitable extensions are demanded on all sides. So desirous are many communities of receiving our service that they are offering bonuses which would, of course, increase the company's profit in such districts. Stockholders, therefore, are invited to make further investments in the securities of the company."

Electric Range Finds Cook Book Recognition.—Mrs. Ida C. Bailey, editor of the "Housewives' Forum" department of the *Pictorial Review*, has recently published a comprehensive cook book which is the first work of its kind to devote any considerable space to the electrical range as a practical unit in household kitchens. Through the efforts of Miss Grace Hadley of the Society for Electrical Development this favorable treatment of the electric range was included.

New California Hydroelectric Plant Put in Service.—The new hydroelectric plant of the California-Oregon Power Company on the Klamath River at Copco, Siskiyou County, Cal., has been put in service. It was dedicated officially on Feb. 2 in the presence of a small group of company officials, together with Prof. C. D. Marx, Stanford University; Prof. D. M. Folsom, Western Petroleum Administrator, and Captain Boyden, U. S. A. Construction work has been under way since 1911. When the site for the dam was stripped it was found necessary to excavate to a depth of 125 ft. before solid bedrock was encountered. The dam rises 125 ft. above the river bed and is approximately 500 ft. across the top. The plant ties in with the company's system serving Siskiyou and Trinity Counties, California, and all of southern Oregon.

New York Edison Savings and Loan Association Results.—With a total membership of 2453 and with assets of more than $500,000, the New York Edison Savings and Loan Association has closed its sixth business year. A new item in the dividend schedule is the shares in military suspense created for the benefit of members, in the army and navy. To these members are apportioned dividends at the installment share rate so that they may have their installment holdings continued without penalty for non-payment during the war. Arrangements have also been effected to cover mortgage accounts of members serving Uncle Sam. The report of the treasurer showed total resources of $547,437, an increase of $121,666 over the previous year. This includes deposits by employees, totaling $486,025. Dividends for the period ended Dec. 31, 1917, were: Installment shares, accumulative prepaid shares and shares in military suspense, 6.25 per cent per annum; saving shares, juvenile saving shares and installment shares in suspense, 5 per cent per annum. The following were re-elected for the ensuing year: Arthur Williams, president; A. A. Pope, vice-president; E. E. Bondy, corresponding secretary; Adolph Hertz, treasurer; J. C. Robinson, financial secretary. E. M. Van Norden, Albert Goldman, W. J. Meara and F. C. Henderschott were re-elected directors to serve for three years.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Illinois Rate Change.—The Illinois Public Utilities Commission has given the Central Illinois Public Service Company, Mattoon, permission to put in effect a rate of 11 cents per kilowatt-hour for residence lighting, this rate covering the first thirty hours, and 9 cents per kilowatt-hour for the excess. The ruling affects twenty-seven towns.

Preferred Stock at Net Price of 90.—The California Railroad Commission has authorized the Western States Gas & Electric Company to issue $178,000 of 7 per cent preferred stock for not less than par, but with permission to allow 10 per cent commission. The proceeds are to pay current indebtedness as hereafter authorized by the commission. The company expended during eleven months of 1917 for improvements and the purchase of properties $816,097.

Free Service Held Unjust Discrimination.—The Indiana Public Service Commission has entered an order denying the responsibility of the Interstate Public Service Company to continue giving free utility service to cities and towns where it operates under indeterminate permits, its former franchises from the cities and towns in question having been surrendered under the public utility act. The ruling is the first on this question by the reorganized commission. The Interstate company asked the commission for relief from further continuance of the practice of giving free service. A recent court decision gave the commission authority to deny free service to a town or city, it is held. The commission order held that such free service constitutes an "unjust discrimination against other consumers."

Reduced Rate in Brooklyn District.—On the recommendation of Commissioner Hervey, the New York Public Service Commission, First District, has ordered the Flatbush Gas Company to reduce maximum electric rates in the Twenty-ninth Ward in the borough of Brooklyn from 12 cents per kilowatt-hour to 10 cents for the six months beginning March 1, 1918, 9 cents for the succeeding six months, and 8 cents thereafter, that is, beginning March 1, 1919; from and after March 1, 1918, not more than 6 cents per kilowatt-hour for energy consumed in excess of two hours' average daily use of maximum demand. The order is to take effect on March 1, 1918. The Flatbush Gas Company serves the Flatbush area of Brooklyn with gas and electricity, but the order affects only the electric rate. The present maximum rate of the Flatbush Gas Company is 12 cents per kilowatt-hour.

Holding Company Control Denied in New York Case.—A decision has been given by the New York Public Service Commission, Second District, on the petition of the Kingston Gas & Electric Company for authority to acquire all of the stock of the Ulster Electric Light, Heat & Power Company and 775 shares of stock of the Upper Hudson Electric & Railroad Company. All of the $700,000 stock of the Kingston company has been owned by the American Gas Company since 1902. Early in 1916 the American Gas Company, without knowledge or consent of the commission, purchased the entire outstanding $30,000 stock of the Ulster company and 775 shares, slightly more than a majority, of the Upper Hudson company $150,000 stock. The object was to consolidate the operations in the area of the three companies. "While the record discloses, and this commission is satisfied, that the American Gas Company acted openly and in good faith in the matter of these purchases," says the decision, "it is, nevertheless, the law of this State that, first, no holding company, domestic or foreign, shall purchase, acquire, take or hold more than 10 per cent of the total capital stock of any domestic gas or electrical corporation (with certain exceptions that are not germane to the particular point now under consideration); and, second, no gas corporation or electrical corporation shall directly or indirectly acquire the stock or bonds of any other corporation engaged in the same or a similar business, unless authorized so to do by this commission. . . . As to the proposed purchase by the Kingston company of the capital stock of the Ulster light company there seems to be no objection raised, and we are of opinion that the same properly may be approved. But purchase by the Kingston company of stock of the Upper Hudson company is strenuously opposed by practically all of the minority interests. While we do not accept all the conclusions of these interests as sound in either law or equity, we are unhesitatingly of opinion that . . there is no proof in the case that the public interest will be advanced by approval of the proposed purchase. Ordinarily such purchases are justified by alleged economies in operation following a merger which is predicated as an essential part of the subject. But as matters stand there can be no merger in this case until the minority interests shall have been acquired; no proposition for a merger or consolidation of the Kingston company with the two others mentioned has ever been made by the present controlling interests, and it is expressly stated that while the American Gas Company desires to effect such consolidation or merger 'eventually,' it has no definite plans in regard thereto at present. We are not convinced . . that to legalize continuance of such an unsatisfactory state of affairs through authorization of something merely not in itself illegal would be proper. Approval of the proposed purchase by the Kingston company of the 775 shares of stock of the Upper Hudson company accordingly should be denied."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Death Brought About by Contributory Negligence.—Where a painter employed by a contractor to paint an iron smokestack used the restricted space of the roof of the substation of a power company as a place to rest his ladder, when live copper power wires, uninsulated, sizzling and hissing with current, were exposed to view, there being no necessity for the use of the substation roof as a place to rest the ladder, such painter was guilty of negligence contributing to his death by electric shock, the Supreme Judicial Court of Massachusetts held in Chartier versus Gardner Electric Light Company (118 N.E. 263).

Indemnity in Concurrent Negligence.—Where defendant negligently allowed its high-tension wire to sag so that it burned through plaintiff railway company's trolley wire, causing it to fall and kill a horse, and plaintiff was required to pay a judgment in favor of the owner of the horse, plaintiff could recover from defendant, though they were joint tort-feasors, since while plaintiff might have adopted some precautions to protect the public, yet as between it and the defendant it could rest upon its rights, and was not required to make structures to protect itself from defendant's negligence, the Supreme Court of New York, Appellate Division, held in Hudson Valley Railway Company versus Mechanicsville Electric Light & Gas Company (167 N. Y. S. 428).

Right of Citizens to Inspect Municipal Records.—The District Court of Appeals in Los Angeles, Cal., has reversed a decision of the Superior Court and holds that W. C. Mushet is not entitled to a writ of mandate directing the Board of Public Service Commissioners of Los Angeles to allow him to examine the records and papers kept by this board in connection with the municipal power project. The board had appealed from the decision of the lower court on the ground that the Los Angeles Gas & Electric Corporation was the party beneficially interested in the suit, rather than the citizens and taxpayers of the city, and that Mr. Mushet was seeking to gain access to the records for the use and benefit of that corporation as a competitor of the city. The District Court of Appeals did not hold that a taxpayer really acting for himself might not examine the books of the Public Service Department, but held that a taxpayer only pretendedly acting for himself, but in fact acting for another person or corporation, had no right to maintain a suit for the purpose of gaining access to its records. The data sought were not public records as defined by the statute.

Harrison Williams has succeeded Samuel Scovil as president of the Cleveland Electric Illuminating Company.

James Favor has been appointed general manager of the Central Power & Light Company, Walnut Ridge, Ark., to succeed John F. Wilson.

F. C. Pratt, after spending six or seven months as manager of the Alliance (Ohio) Gas & Power Company, is again attached to the Doherty general engineering staff.

Terrell Croft has become connected with the Luminous Unit Company of St. Louis, Mo., as chief electrical engineer. Mr. Croft is well known as the author of several practical works on electrical engineering.

Albert R. Thompson, general superintendent of the electric distribution department, San Francisco district of the Pacific Gas & Electric Company, has gone to Camp Lee, Petersburg, Va., as captain in the Engineers' Reserve Corps.

M. H. Aylesworth has resigned as a member of the Colorado Public Utilities Commission, of which he was chairman, to become assistant to the vice-president and general manager of the Utah Power & Light Company. Mr. Aylesworth is a practicing attorney.

W. B. Miser, manager of the Oklahoma Gas & Electric Company, Drumright, Okla., has been appointed chairman for Drumright of the Military Training Camp Association, which has for its object the securing of competent men for inspection of equipment for the division signal corps.

J. M. Atkinson has been transferred from the post of manager of the Missouri Valley Light & Power Company, El Dorado Springs, Mo., to manager of the Big Horn Light & Power Company, Worland, Wyo. Prior to going with the Missouri Valley property, late in 1915, Mr. Atkinson was manager of the La Plata Light, Heat & Ice Company.

H. L. Thomson, assistant superintendent, has been appointed superintendent of the lighting department of the Hartford Electric Light Company, to succeed F. W. Prince, April 1. Mr. Thomson has been with the Hartford company for about six years and has been in close touch with both technical and commercial lighting work on the system, including the service of the model meter laboratory at the lately completed offices of the company.

G. McKew Parr, general sales manager of the Hart & Hegeman Manufacturing Company, Hartford, Conn., is on an indefinite leave of absence to serve under the War Trade Board, at Washington, as a volunteer worker. Mr. Parr, who is a graduate of the United States Military Academy at West Point, has been associated with the Hart & Hegeman company since 1909. For two years he represented the company in the Southern territory, when he became advertising manager, continuing in that position until early in 1914, when he was appointed general sales manager.

Men of the Industry

Changes in Personnel and Position— Biographical Notes

R. E. Williams, formerly superintendent of the Little Rock Railway & Electric Company heating department, has been appointed assistant superintendent of the company.

L. E. Brown of Jackson, Mich., has been appointed superintendent of distribution for the Springfield (Ohio) Light, Heat & Power Company to succeed R. L. Gouty, who resigned because of ill health.

J. A. Perkins, formerly manager of the rate and statistical department, has been elected a vice-president of the United Gas & Electric Engineering Corporation. Mr. Perkins assumed his new office Jan. 10, and will continue the direction of rate and statistical matters.

P. T. Philips of the Little Rock (Ark.) Railway & Electric Company has been appointed general superintendent of both the electric and heat departments and will have full authority over power-house operation. This appointment is incidental to the merging of the heating business with the other departments.

Robert H. Whitten, after some five years of city planning work with the Heights of Buildings Commission and as secretary of the Commission on Building Districts and Restrictions and the committee on the city plan of the Board of Estimate and Apportionment of New York, has opened an office for consulting work on city planning and zoning at 277 Broadway, that city. Mr. Whitten was for some time librarian-statistician for the New York Public Service Commission, First District, during which time he contributed considerably to the technical press besides compiling a standard work on commission regulation.

G. A. Strain has been promoted from being superintendent of the gas department of the Helena (Mont.) Light & Railway Company to the position of general superintendent of the following properties, with headquarters at Ithaca, N. Y.: Homer & Cortland Gas Light Company, Cortland, N. Y.; Ithaca Gas & Electric Corporation, Ithaca, N. Y.; Norwich Gas & Electric Company, Norwich, N. Y.; Oneonta Light & Power Company, Oneonta, N. Y.; Standard Light, Heat & Power Company, Sidney, N. Y.; Van Wert Gas Light Company, Van Wert, Ohio; Cayuga Power Corporation, Ithaca, N. Y.; Groton Electric Corporation, Groton, N. Y.; Ovid Electric Company, Ovid, N. Y. Mr. Strain has been associated for the last twelve years with the operating organization of the J. G. White Management Corporation, New York City, the manager of the aforementioned companies.

George E. Erb has been appointed a member of the Idaho Public Utilities Commission, succeeding Axel P. Ramstet, former president of the commission, who resigned about a year ago.

Alfred C. Jordan, commercial manager of the Cumberland County Power & Light Company, Portland, Me., has been appointed superintendent of the railway, succeeding George S. Brush, resigned.

Loyall A. Osborne of New York, vice-president of the Westinghouse Electric & Manufacturing Company and chairman of the executive committee of the National Industrial Conference Board, has been appointed by the Secretary of Labor as a member of a committee on industrial peace during the war. This committee, which consists of five representatives of employers, five labor leaders and two public men, will provide a definite labor program in order that there may be industrial peace during the war, thus preventing any interruption of vital industrial production.

H. W. Fuller, who has been associated with H. M. Byllesby & Company for seven years, devoting a large part of his time to the solution of special operating problems, has been appointed vice-president in charge of operation of the Northern States Power Company, a newly created position. Mr. Fuller was born in New York and received his early education in the public schools of Bayonne, N. J., the State Model School of New Jersey and Rutgers College, being graduated in 1891. He entered the service of the Consolidated Traction Company of Newark, N. J., and became assistant superintendent and assistant general manager, leaving this position in 1901 to become general manager of the Washington Railway & Electric Company and the Potomac Electric Power Company. In 1911 he severed his connection with these properties to become associated with the Byllesby interests. He was appointed vice-president and general manager of the Appalachian Power Company, Bluefield, W. Va. The following year he went to Louisville, where, under General G. H. Harris, he had general supervision of the local Byllesby properties.

Obituary

Judson D. Holden, chief night electrician for the Aurora, Elgin & Chicago Railroad Company, was instantly killed a few days ago by an excessive charge of electricity.

L. R. McBroom, formerly superintendent of the Burlington (Vt.) light plant, died recently at the naval base, Norfolk, Va. At the time of his death Mr. McBroom was an electrical engineer at the government shipyards.

William Clegg, Jr., formerly district manager for the Westinghouse Electric & Manufacturing Company, with headquarters at St. Louis, died recently in that city. He was born in Franklin, La., and was graduated from the Louisiana State University at Baton Rouge.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies— Notes on Industrial Activities and Business Methods

DISCOUNT CHANGES SCHEDULED FOR HEATING APPLIANCES

Greater Differential Between Central Stations and Jobbers on Socket Appliances—Central Stations Recognized in Range Discounts

A new schedule of discounts on electric heating devices has been arranged, effective April 1. It appears that the licensors in making the present readjustments of the schedules under the Marsh patents have had in mind granting to the central stations an improved discount relative to jobbers on electric ranges and on the other hand have improved the jobbers' discount relative to central stations on socket devices.

Under the old schedule the socket device discounts to central stations were 30 and 10 with an extra 7½ for a bona fide order placed at any one time for $5,000 worth of material for shipment within thirty days. Under the new schedule the basic central-station discount on socket devices will be 30 and 7½ with an extra 7½ for a bona fide order placed at any one time for at least $5,000 worth of material for shipment within thirty days.

On electric ranges the former schedule to central stations of 25 and 10 (5 per cent for carload lot) with an extra 5 for a bona fide order placed at any one time for at least $6,000 worth of material for shipment within one year will still be 25 and 10 (5 per cent for carload) for small orders, but for a bona fide order placed at any one time for at least $10,000 the discount will be 25, 10 and 10 (5 per cent for carload).

The changes actually amount to increasing the differential between the jobbers and central stations by about 2 per cent on socket devices and to recognizing the quantity purchases of ranges by the central station. For some time the jobbers have been outspoken in the contention that the discount differential between the jobbers and the central stations was not great enough to insure a profit. The new schedules, it will be noticed, have not changed the differential between the jobber, the contractor-dealer and the department store.

On ranges there has been a disposition on the part of central stations, particularly those on the Pacific Coast, where the development of the electric range load has been large and rapid, and those others that are active on a large scale in the electric range business, to protest against a wider margin of profit for the jobber than for the central station, which it was pointed out assumes almost the entire retail development burden.

In making these changes in schedule on socket appliances the central stations purchasing heating devices in small quantities are placed on the same basis as the dealers and other merchants who purchase heating devices in small quanties for resale. The jobbers, on the other hand, who as the socket device business has developed have been recognized as becoming more and more the logical outlet in the distribution of socket appliances, are given an opportunity for making a better profit than under the old schedule.

On electric ranges it is apparent that the contention of the central stations that are purchasing ranges in large quantities and are conducting expensive campaigns for the introduction of the electric range, together with assuming the burden of exploiting the business, that they should receive the maximum discount on ranges, namely, the same as the largest jobber discount, has been recognized.

As was stated in these columns, there will be no schedule increase at the present time. Although the greatly increased costs seemed in many instances strongly to warrant higher lists, the licensors did not feel that an advance was just now advisable.

NEW FREIGHT ARRANGEMENTS TO IMPROVE TRANSPORTATION

With Few Exceptions, All Eastern Shipments Are on a Priority Basis—Consignee, Not Shipper, the One Considered

Early this year A. H. Smith, assistant to Director General of Railroads McAdoo, as a war emergency measure, created a "Freight Traffic Committee, North Atlantic Ports," for the issuance of inland shipping permits on export freight and also on all matters pertaining to domestic freight in its jurisdiction. A domestic division was also named, with offices in New York City.

For the present the domestic division will only assume control of carload domestic freight, embargoed as defined as follows, for Manhattan Island, the Bronx (New York City), and station or lighterage deliveries on New York Harbor: On Jan. 15, 1918, embargoes became effective on carload domestic freight (except food for human consumption, newsprint paper, live stock, perishable freight, coal and freight consigned to an officer of the United States government or to officers of the railroads); exceptions thereto will be covered by shipping permits to be issued by the domestic division, Freight Traffic Committee, North Atlantic Ports, and no railroad shipping permits will be issued except by the domestic division.

In observance of the procedure on carload domestic freight it is necessary that the consignee (not the shipper) shall make application for permit as follows: (a) For lighterage deliveries, to lighterage representative of the delivering road; (b) for pier, station or team track deliveries, to railroad representative at the delivery desired.

The lighterage representative or the railroad representative, as the case may be, will then present to the domestic division application for the issuance of railroad shipping permit for the forwarding of the freight from point of origin. Shipping permits will be sent to the consignee through the same channel. Consignee will send the permit to the shipper, which permit must be surrendered by the shipper to the initial road's agent, with bill of lading and shipping order. Permits will be issued under serial numbers bearing "F. T. C." prefix and waybilling agents must indorse on card and revenue billing reference to authority "F. T. C. No. ——," otherwise cars will be rejected at junctions.

On Feb. 8, also, as a war emergency measure, the Pennsylvania Railroad system put into effect on all of its lines east of Pittsburgh a new plan of handling freight under embargoes. The purpose is to render every possible assistance to shippers and consignees in securing transportation of materials and supplies that are most urgently required, and also to simplify the procedure necessary to obtain authorization for the movement of essential freight in times of general embargoes.

The new plan will be applied to the administration of the present embargoes on the Pennsylvania lines east of Pittsburgh, as well as to all future embargoes that may be laid, until further notice. It will probably remain in effect for the duration of the war and as long thereafter as necessary.

Under the new plan, during the existence of an embargo, freight will be handled through a system of special permits covering each individual shipment. In this connection a radical change will be introduced by which the consignee, and not the shipper of the freight, must apply for the permit. This changes completely the present system under which either the shipper or the consignee may apply for exceptions to embargoes.

The essential feature of the new plan is that before

authority will be granted to move freight affected by embargo the person who is to receive the shipment must demonstrate, to a reasonable degree, two things:

1. That the shipment is necessary to meet his existing requirements.

2. That he will be able to accept the freight promptly on arrival, unload the cars without delay and take the shipment off the railroad's hands.

In determining whether or not a permit shall be granted for a given shipment, two factors will control: (1) Road and terminal conditions existing at the time; (2) the urgency of the consignee's needs and his ability to unload.

In the past, where shippers instead of consignees frequently obtained permits, it was found that much freight was started on the road far in advance of the consignee's needs. It was also found that many shipments were made which the consignee was unable to accept upon arrival.

Much confusion and delay is expected to be obviated by this arrangement, which does not apply to export traffic via New York, Philadelphia and Baltimore, or to domestic carload shipments to New York. The latter is in charge of the Freight Traffic Committee above mentioned. No other railroad system has formulated a similar declaration. Increased transcontinental freight rates, which go into effect March 15, were granted by the Interstate Commerce Commission. These rates were asked for by the railroads prior to government control.

Conditions have improved in the East on deliveries, but they are far from normal. They are expected to reach that stage, weather permitting, about the middle of the month. Express and parcel post transportation is being used by shippers wherever possible, notwithstanding the extra cost, for emergency deliveries. The express companies are said to be literally swamped with business, and with the labor scarcity they find it impossible to handle it all.

METAL MARKET SITUATION

Copper in Small Lots in Good Supply—Official Price on Zinc Announced

Very little fluctuation is occurring in copper; that is as to supply or price. Producers and speculators are usually in a pessimistic frame of mind when discussing the amount of the metal coming from the mines and are doubtless sighing for a higher government price on the ground that it would stimulate production. The speculators are playing a good and, when opportunity serves, a strong second, when it comes to boosting the market along price lines. It is evident, however, that there is enough copper for jobbers and sellers of less than car lots for commercial manufacturing uses. Wire manufacturers of rubber-covered, cable, weatherproof, insulated tape and other varieties are selling large bills to the government.

An official or government price has been established by the War Industries Board for zinc on practically the same conditions as control the sale of copper, subject to revision June 1. The minimum price is 12 cents per pound f.o.b. East St. Louis for producers; sheet zinc, 15 cents per pound, and plate zinc 14 cents per pound f.o.b. plant or smelter, subject to the usual trade discounts.

NEW YORK METAL MARKET PRICES

	Feb. 18	Feb. 25
	£ s. d	£ s. d
Copper:		
London, standard spot	110 0 0	110 0 0
Prime Lake	Govt. price 23.50	Govt. price 23.50
Electrolytic	Govt. price 23.50	Govt. price 23.50
Castings	Govt. price 23.50	Govt. price 23.50
Wire base	27.00	27.00
Lead, trust price	7.00	7.00
Nickel, ingot	50.00	50.00
Sheet zinc, f.o.b. smelter	15.00	15.00
Spelter, spot	7.92½	7.92½
Tin, Straits	*85.00	*85.00
Aluminum, 98 to 99 per cent.	34.00 to 36.00	35.00 to 37.00
OLD METALS		
Heavy copper and wire	21.50 to 22.00	21.50 to 22.00
Brass, heavy	14.00 to 15.25	14.00 to 15.25
Brass, light	10.00 to 10.50	10.00 to 10.50
Lead, heavy	6.25 to 6.50	6.25 to 6.50
Zinc, old scrap	5.50 to 5.75	5.50 to 5.75

*Nominal.

THE WEEK IN TRADE

FEBRUARY showed an increasing business over January in the volume and value of sales for all lines of staple electrical goods. A large proportion of this growing trade is due in great measure to the requirements of the government in its varied enterprises connected with the war. In fact, as has been noted before, this buying, in some instances on a gigantic scale, practically dominates every branch of the industry. On this account shortages are either imminent or a reality in lamps of various types, floodlamps, conduit, porcelain goods, etc. The civilian demand is strong for domestic appliances—heating and cooking equipment especially—dry batteries and vapor lamps. Freight embargoes East and West continue to hamper deliveries and in some cases cause uneasiness for needed stock, but improved weather conditions will doubtless relieve the present acute situation.

Collections are mentioned as being favorable with a weakness in connection with public utility accounts. Credits are held along firm lines.

NEW YORK

With a great deal of improvement in the clearing up of freight congestion at Atlantic seaboard points, particularly in and about New York City, yet no measurable relief is being afforded receivers of electrical equipment or the general line of merchandise. Where priority orders prevail for governmental needs goods have been given a preference and deliveries made. Notwithstanding the natural curtailment of trade on this score, business is reported in very satisfactory volume. The demand for electrical supplies and accessories of every description has not shown any falling away, according to the statements of representative jobbers and dealers. The difficulty of obtaining goods at a specified time is annoying and disturbing, and for the promises of manufacturers and distributers due allowance is made when fulfillment is lacking. Everybody is in the same dilemma, and therefore commendable patience and consideration seems to be the rule and not the exception.

From a financial standpoint the trade, as a whole, express satisfaction with collections, and some houses with numerous accounts are rather pleased they are in such excellent condition. A watchful policy is enforced on credits.

CODE WIRE.—With building operations not only at a very low level and still further restricted by the government, which advises that materials, labor and credit be not utilized for this purpose unless the need is urgent, the sale of code wire is not running into large amounts. Prices are at a stationary figure and likely to remain so.

DRY BATTERIES.—A fair business is reported in dry batteries. The supply has bettered, and jobbers specializing on these goods report strong stocks, with no variation in quotations.

LAMPS.—For a while the sale of carbon incandescents was large and increasing, but now, the trade states, the specifications are not so heavy as before the first of the year. The demand is dropping off, and the metallic-filament lamps receive preference in a majority of the important orders booked.

PIPE FITTINGS.—A short market is spoken of in describing the situation on pipe fittings. They go out as fast as received from the manufacturers, and it is difficult to buy, let alone accumulate stock.

INTERPHONES.—The demand locally is of considerable volume owing largely to a number of gigantic hotels now being erected, such as the Commodore, with 2000 rooms; the Pennsylvania, with nearly the same high rooming capacity, and several others, and to the shipyards in the harbor—

about forty besides those all along the coast—which are to be equipped. Local jobbers, as a rule, do not aim to bid on such contracts, as it would exhaust their stock, with poor expectation of early replenishment.

CONDUIT.—On large size it is almost impossible to obtain any stock, as the embargoes are holding up shipments from the producers. Both on non-metallic and metallic flexible conduit stocks are said to be low.

OUTLET BOXES.—A very satisfactory supply is held in this market. Prices have not changed, discounts ruling about the same for quite a while.

HEATING DEVICES.—A steady sale in irons is spoken of. In fact, in the regular line of household table and energy-consuming devices trade is all that could be expected, with prospects better as the spring trade opens. The new discounts, effective April 1, are given in another column.

ATTACHMENT PLUGS.—Jobbers report a business above the normal with no revision in the selling figures.

SOCKETS.—Standard sockets are said to be in good supply. On special makes, with fixtures for saving energy, a good sale, due to effective merchandising methods, is recorded.

PORCELAIN.—On cleats and knobs, for which the government has called in heavy lots, stock is not easily to be had. This applies also to everything on the list of staples which are being requisitioned officially for the equipment of either foreign or domestic military and naval establishments.

CHICAGO

The more pleasant weather which prevailed in the latter part of February and the nullification of the Garfield order seem to have permitted people to get back to work on a more serious basis. Buyers appear to be in the market to replenish stocks. There is every indication that February will show itself as a good month in the trade. There have been no price changes in the past week, but certain small changes are expected to develop shortly. The big event in the trade in Chicago in the last week was the meeting of the contractor-dealers to organize as a State association under the Pacific Coast merchandising plan. About 325 contractor-dealers, jobbers, central-station men and manufacturers attended the sessions of this convention.

WIRE.—One firm which has been selling partly on a 30-cent base, but on a slightly higher base for small quantities, is now entirely on a 30-cent base for rubber-covered wire. The manufacturers of weatherproof wire are telling the trade to expect higher prices on account of the higher prices of cotton. These manufacturers state that they would not be able at the present time to make the prices to the trade which they are quoting were it not for the fact that they bought cotton considerably in advance of requirements. A price change based entirely on the increased cost of cotton would not be large, it is thought, on account of the small amount of cotton per pound of weatherproof wire which enters into the manufacture. Nevertheless it is believed by some jobbers that it might affect the delivery situation on weatherproof wire, since cotton is very difficult to secure.

CONDUIT.—A study of conduit sales made by one Chicago jobber showed that during the month of December 61 per cent of the conduit shipped from his stock had been used for what was construed to be war purposes.

DOMESTIC APPLIANCES.—The demand which has been noted for lower-priced merchandise is said to be continuing until it has developed into a well-defined tendency in that direction. It is understood that the demand for lower-priced portable lamps will be met by one manufacturer, who is putting out a new line especially for this class of trade.

DRY BATTERIES.—The markets are absorbing practically all that can be manufactured and delivered. There have been persistent rumors about higher prices of batteries, but it is stated on good authority that there will probably be no increase at the present time, despite the fact that the cost of producing batteries is higher now than it has been in the past. There seems to be a desire on the part of producers to keep battery prices as low as consistently possible.

ELECTRIC RANGES.—Orders are beginning to arrive from widely separated sections of the country, but it is noticed that most of the buying and inquiries is from central stations in the smaller communities. Nevertheless large shipments are being made in some instances.

BOSTON

Business holds up well with the larger jobbers, but a perceptible falling off is reported among the smaller houses. Well-informed opinion, however, regards the slackening as temporary. With the country hitting its full stride in war preparations, readjustments cause some uncertainty, but the absolute necessity of co-ordination among distributing agencies as well as in production insures the maintenance of a heavy volume of trade for the duration of hostilities. Stocks are increasing in many quarters and the larger establishments are already planning to meet the demands for electrical supplies and equipment which will accompany the construction of a new eight-million-dollar transatlantic shipping terminal at Boston by the government. Labor is uneasy this week in this district, strikes being threatened in Massachusetts telephone operators' ranks and on the Boston Elevated Railway. It is expected that the latter difficulty will be settled through arbitration and that local industry will not be further disrupted. Jobbers and retailers alike are rejoicing over the stoppage of workless Mondays, which have caused much disorganization and which threatened to lead to no little industrial emigration from New England. Collections are fair and deliveries improving somewhat on small motors, asbestos insulation and wire. This is apparently due to improved conditions at the factory rather than to better railroad service. A price advance of $25 in Delco lighting sets was scheduled for March 1.

LAMPS.—Orders are now being well handled; portables are quieter, and lengthening days are curtailing service to the betterment of stocks. Bulk orders are not encouraged, however. Government business is exceedingly active.

WIRE AND CABLE.—Railroad conditions show no improvement as yet with respect to wire transportation. Prices remain unchanged, with rubber-covered wire quoted at 30 to 31 cents base and weatherproof at 28 to 29 cents. On quantity orders some manufacturers are quoting perhaps 4 to 5 cents less than the above in extreme cases.

CONDUIT.—Deliveries are reported worse than ever. Pipe from 2 in. up is in great demand, and one jobber stated that 3-in. and 5-in. conduit is almost worth its weight in gold at present. The government is a heavy buyer. No prospect of unloading large stocks of small-sized conduit as yet appears capable of realization.

MOTORS.—Smaller sizes are getting fairly plentiful. Prices are firm, and early advances have been rumored on single-phase outfits, but nothing can be found to support this view at the moment. Large motors are scarce, and a Boston dealer seeking eight 350-hp. machines for early service reports no success in filling the order. Delivery in six weeks is now quoted on motors as large even as 40 hp. and smaller sizes down to one week, with immediate shipment from stock on fractional motor orders in many cases.

DRY BATTERIES.—Three dry cells are now sold to one wet battery, one large dealer reports. Dry cells are quoted at 40 cents each in less than dozen lots, and 35 cents in the latter. No advance has occurred for three months. Flashlamp business is quiet except for military use, but in a few weeks the stir of the vacation trade will begin to be felt.

FARM LIGHTING SETS.—These units are in good demand. A price advance of $25 on Delco sets was scheduled for yesterday, making the 80-amp.-hr. outfit $395, and the 160-amp.-hr. outfit $465.

FIBER CONDUIT.—Central-station demand is very small, and the prospects are unfavorable except in the industrial field. Four feet to 6 ft. of frost will delay outside work somewhat this spring, it is felt.

EBONY BOARD.—Government demands are heavy; deliveries are somewhat improved, probably on account of increased factory facilities. Prices hold firm.

ATLANTA

The embargo on the Eastern railroads covering shipments for the Southeast is beginning to be keenly felt by the various manufacturers and distributers in this section. Quantities of electrical supplies have been received lately, but this was due largely to the fact that the freight in question had been started and was consequently moved out of the embargoed area. Moreover, these shipments were long overdue. The method of freight movements now in use, by which the railroads are permitted to receive freight on two days and to embargo on five, has helped to relieve the situation to some extent in individual cases; but on the average shipment, where no priority movement can be secured, the hardship is great and a number of important jobs are being delayed considerably. On the whole, the problem of deliveries covering all lines is more serious now than for some time.

Secretary McAdoo's expression regarding the financing of public utilities and the recommendation for higher rates was favorably received and came at a time when the needs of all public service companies are very pressing. While the necessity for higher rates and additional funds for extensions is great over all this section, the Atlantic and Gulf ports appear to be in the worst shape. The shipbuilding industry and the phenomenal demands for energy in all associated lines has placed a burden on these stations. It is expected, then, in view of the administration's policy along this line, that much-needed equipment will be purchased even in the face of long shipments.

BELL-RINGING TRANSFORMERS.—The demand continues steady. Shipments heretofore have been good, but stocks are getting low owing to poor deliveries to jobbers from the East.

HEATING DEVICES.—Activity in all lines is very strong and the volume of sales shows a slight increase over January.

TEXTILE MOTORS.—The call for this type of apparatus shows some stimulation over last week, manufacturers reporting a large number of inquiries and some good orders. This field is handicapped at present by the fact that most of the power companies are pretty well loaded.

CHARGING OUTFITS.—The market for these is excellent and trade is very brisk. Deliveries have been good.

SEATTLE

The volume of business generally was gratifying during the past week, with wholesalers and retailers showing increases over the corresponding week of last year. Sales over last week showed but a slight increase, except in the case of floodlamps, wiring devices and sewing machines, which continue prime movers. In domestic appliances, washing machines are selling well, and sales of electric irons show a slight increase. There is no noticeable increase in buying from government or industrial plants. The volume to shipyards increased slightly, particularly in Portland and Gray's Harbor. Stocks of motors, conduit of the larger size, wire and lamps are very low. There is no change in prices in any line worthy of comment and no strikes are imminent in the Northwest. Collections to date are satisfactory. Credits are well in hand.

Authorities agree that unless something is done to relieve labor shortage, there will be a smaller acreage under cultivation this year in the Northwest. Dire shortage is threatened in the agricultural sections on account of enlistments, the draft and the rush to shipbuilding cities. Business houses, including jobbers, will be forced to resort to female help or run short-handed. The government may have to enlist men for farm work, as it has for shipbuilding and lumber production. It is impossible to obtain household help. Dealers say this accounts for the heavily increasing sales of electrical labor-saving devices. Residence building and remodeling continues to increase in Tacoma, Seattle and other shipbuilding centers. Residence building in Portland is beginning to rush.

Freight destined for Seattle and Northwest points, held up in the East by embargoes against Western freight, has begun to move slowly, and there is a gradual increase in freight receipts. Contracts will be awarded shortly for two additional units for cantonments at the Puget Sound Navy Yard and five units at Camp Columbia, near Vancouver, Wash. Plans for materially increasing the size of Camp Lewis, near Tacoma, are being formulated. The production of lumber the last week was 8 per cent of normal; shipments 71 per cent of normal.

FLOODLIGHTS.—Orders are pouring in faster than can be supplied. The biggest demand is from Portland and the Gray's Harbor shipbuilding districts. There is an extreme shortage of certain types. Prices have not advanced.

LAMPS.—There is a heavy movement and stocks are extremely low. The usual volume to the shipyards and industrial plants is supplemented by heavy buying for new construction. Prices are firm.

WIRING DEVICES.—These goods are experiencing a lively movement, with residence construction making fresh demands. Stocks are in fair condition; prices remain the same.

CONDUIT.—The demand from shipyards has decreased in the past two weeks, but the demand for new construction is increasing. Deliveries are causing considerable alarm. Shortages exist in jobbers' stocks. Apparently shipyards have ample for immediate needs.

FIXTURES.—The volume of sales by retailers is increasing daily. Indirect lighting is in great demand for new residences. Stocks appear ample.

SAN FRANCISCO

The past week has been noticeable for the first steady rain of the season, averaging 2 in. along the coast and 4 in. in the interior valleys. The rain was accompanied by a snowfall 3 ft. deep on the mountains, and the long line of snow-covered Sierra peaks was a most gratifying sight to central-station men.

However, the sale of pumping plants continues brisk, although hampered by diminishing stocks. Speedy replacement of sales is impossible because of the freight embargo placed east of the Mississippi River upon all commodities except foodstuffs and munitions. The time in transit required for cars to the Pacific Coast from Atlantic and central points is double what it was before the congestion, and with the rail tie-up it is evident that no early relief may be expected. Conduit stocks are very low with no prospect of improvement because of the war-time activities of the producing mills.

Electrical contracting business continues good, with plenty of small wiring jobs, in spite of the fact that early prophecies of 1918 conditions discounted such work in favor of industrial and governmental contracts. Rubber-covered wire sales are brisk, and the anxiously awaited shipments speedily melted before the back orders awaiting them. Factory shipments are fair. Interphones are evidence of the increase in private installations, for several jobs have been recently let in the interior cities.

Fuel shortage, the scarcity and high wages of household help and a feeling of personal sacrifice engendered by war conditions have united to form a wedge long needed to pierce popular ignorance and indifference to the merits of household electrical devices. The fuel situation, which cripples Eastern central stations, results in more business for California's hydroelectric plants. The officer in charge of the army hospital at Camp Fremont recently stated that were there another shortage of coal in the camp (the government having provided coal stoves) he would ask for an electrified heating and cooking equipment. The officials of the navy hospital, at Mare Island, have already made such a requisition. Camp Curry, an exceedingly popular resort in the Yosemite Valley, has just purchased two large hotel-type ranges, a 180-loaf baking oven and a hotel-size bread toaster, with a cottage radiator and water-heating system to follow. The Southern Pacific company intends to equip its fine modern hotel on the Apache Trail, near Yuma, Ariz., with an electrical kitchen and grill and water-heating system.

So much for the larger equipment; but unless the mountain snowfall continues heavy and packs harder for frozen storage, there will be no organized campaigns for the sale of domestic ranges and water heaters this year.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List per 1000 Ft.
No. 14 solid	$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	List to $61.00
Coil to 1000 ft	10% to 59.17
	No. 12 Solid
Less than coil	List to $71.00
Coil to 1000 ft	—10% to 68.87

Twin-Conductor

	No. 14 Solid
Less than coil	List to $105.00
Coil to 1000 ft	$70.00 to 10%
	No. 12 Solid
Less than coil	List to $135
Coil to 1000 ft	10% to $130.95

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	+ 10% to + 20%
Coil to 1000 ft	5% to 10%
	No. 12 Solid
Less than coil	+ 10% to + 20%
Coil to 1000 ft	—10% to 5%

Twin-Conductor

	No. 14 Solid
Less than coil	List to $115
Coil to 1000 ft	—10% to $80
	No. 12 Solid
Less than coil	+ 10% to + 20%
Coil to 1000 ft	—10% to 5%

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each. Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	10% to $24.00
1/5 to std. pkg	20% to 19.80
Std. pkg	34% to 18.75

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+ 10% to 12%
1/5 to std. pkg	20% to 10%
Std. pkg	34% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40	$0.40
12 to 50	.35	.35
50 to barrel	.31	.32
Barrel lots	.28 to .285	.29 to .295

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40	$0.40
12 to 50	.35	.35
50 to barrel	.3175	.3275
Barrel lots	.2875	.2975

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List, Per 100 Ft.
5/16	250	$5.00
3/8	250	7.50
1/2	100	10.00
3/4	50	13.00
1	50	21.00
1 1/4	50	26.00
1 1/2	25–50	35.00
2	25–50	45.00
2 1/2	25–50	52.00

NET PER 1000 FT.—NEW YORK

	Less Than Coil	Coil to 1000 Ft.
3/8-in. s. stp.	Net to $75.00	—15% to $69.75
3/8-in. d. stp.	+10% to 75.00	List to 72.00
1/2-in. s. stp.	List to 100.00	—15% to 93.00
1/2-in. d. stp.	+10% to 100.00	List to 96.00

NET PER 1000 FT.—CHICAGO

	Less Than Coil	Coil to 1000 Ft.
3/8-in. single strip	$75.00	$63.75
3/8-in. double strip	78.25 to 78.75	71.25
1/2-in. single strip	100.00	85.00
1/2-in. double strip	105.00	95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List Per Foot	Size, In.	List Per Foot
7/32	$0.05 1/2	1	$0.25
1/4	.06	1 1/4	.33
3/8	.09	1 1/2	.40
1/2	.12	1 3/4	.47
5/8	.15	2	.55
3/4	.18	2 1/4	.65

NET PER 1000 FT.—NEW YORK

Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in. $25.00-$55.00	$20.50-$24.50	$20.00-$21.50
1/4-in.— $28.00-$60.00	$22.50-$27.00	$22.00-$23.50

NET PER 1000 FT.—CHICAGO

Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in. $36.67-$55.00	$25.00	$22.50
1/4-in.— $40.00-$60.00	$27.00	$25.00

CONDUIT, COUPLINGS AND ELBOWS. RIGID IRON

Card No. 38

Size, In.	Conduit, List per Foot
1/4	$0.08 1/2
3/8	.08 1/2
1/2	.08 1/2
3/4	.11 1/2
1	.17
1 1/4	.23
1 1/2	.27 1/2
2	.37
2 1/2	.58 1/2
3	.76 1/2

	Couplings, List	Elbows, List
1/4	$0.05	$0.19
3/8	.06	.19
1/2	.07	.19
3/4	.10	.25
1	.13	.37
1 1/4	.17	.45
1 1/2	.21	.50
2	.28	1.10
2 1/2	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

	1/4 in. to 1/2 in.	3/4 in. to 3 in
Less than 2500 lb.	4% to 6%	7% to 9%
2500 to 5000 lb.	6% to 8%	9% to 11%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	1/4 in. to 1/2 in.	3/4 in. to 3 in
Less than 2500 lb.	2.8% to 3.7%	5.8% to 6.7%
2500-5000 lb.	4.8% to 5%	7.8% to 8.7%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price	$6.00
Discount	30%

CHICAGO

List	$5.00
Discount	25%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50
600-Volt		
3-amp. to 30-amp.	100	$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	28%
1/5 to std. pkg	38%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	28%
1/5 to std. pkg	38%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.	$5.00 to $5.75
1/5 to std. pkg.	4.50

Standard package, 500. List, each, $0.07

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.	$6.25
1/5 to std. pkg.	5.25

Standard package, 500. List, each, $0.07.

LAMPS, MAZDA

105 to 125 Volts

Regular, clear:	Std. Pkg.	List, Each
10 to 40-watt—B	100	$0.30
60-watt—B	100	.35
100-watt—B	24	.70
75-watt—C	50	.70
100-watt—C	24	1.10
200-watt—C	24	2.20
300-watt—C	24	3.25
Round bulbs, 3½ in., frosted:		
15-watt—G 25	50	.53
25-watt—G 25	50	.55
40-watt—G 25	50	.55
Round bulbs, 3¾ in., frosted:		
60-watt—G 30	24	.77
Round bulbs, 4¾ in., frosted:		
100-watt—G 35	24	1.10

DISCOUNT—NEW YORK

Less than std. pkg.	Net
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	Net
Std. pkg.	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$24.90 to $31.00
Coil to 1000 ft.	22.72 to 27.90

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$29.00 to $30.00
Coil to 1000 ft.	21.50 to 22.50

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100	$20.00 to $29.00

CHICAGO

Net per 100	$19.75 to $24.00

OUTLET BOXES

Nos.	List, per 100
101—A, A1½, 4 S.C., 6200, 320	$30.00
102—B.A., 6200 S.E., 300, AX, 1½, 4 S.	30.00
103—C.A., 9, 4R, B 1½	25.00
106—F.A., 7, C.S., 1½, 3 R	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	25%-37%	20%-32%
$10.00 to $50.00 list	42%-45%	37%-40%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	40%	35%
$10.00 to $50.00 list	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	$20.00 to $38.00
1/5 to std. pkg.	19.00 to 20.00

Standard package, 2200. List per 1000, $20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	$15.80
1/5 to std. pkg.	14.80

Standard package, 2200. List per 1000, $20.

PORCELAIN KNOBS

NEW YORK

Per 1000 Net	Std. Pkg. 3500	Std. Pkg. 4000
	5½ N. C.—Solid Nail-it—N.C.	
Less than 1/5 std. pkg.	$27.50 to $29.00	$30.75
1/5 to std. pkg.	15.60 to 20.75	24.20

CHICAGO

Per 1000 Net	Std. Pkg. 3500	Std. Pkg. 4000
	5½ N. C.—Solid Nail-it—N.C.	
Less than 1/5 std. pkg.	$11.85	$30.75
1/5 to std. pkg.	11.10	24.20

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
⅛-in. cap key and push		
⅛-in. cap key and push sockets.	500	$0.33
⅛-in. cap keyless socket	500	.30
⅛-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net to $23.00
1/5 to std. pkg.	20% to 21.00

NET PER 100—CHICAGO

Less than 1/5 std. pkg.	14% to $25.00
1/5 std. pkg.	30% to 23.00

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T.	$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1.80
60-amp. 3 P. S. T.	2.68
100-amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Low Grade:	
30-amp. S. P. S. T.	0.42
60-amp. S. P. S. T.	0.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	0.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	List to + 5%
$10 to $25 list	11%
$25 to $50 net	14% to 15%
	Low Grade
Less than $10 list	5% to 10%
$10 to $25 list	16%
$25 to $50 list	24% to 25%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+5%
$10 to $25 list	10% to 11%
$25 to $50 list	—14%
	Low Grade
Less than $10 list	5%
$10 to $25 list	—16%
$25 to $50 list	24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd

10-Amp. 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	List
1/5 to std. pkg.	15%
Std. pkg.	28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+20% to list
1/5 to std. pkg.	List to —15%
Std. pkg.	List to 30%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List Each
No. 155	$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	List	Net
$2.00 to $10.00 list	10% to 20%	5%
$10.00 to $50.00 list	20% to 30%	15%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $2.00 list	25%	15% to 20%
$2.00 to $10.00 list	25%	20%
$10.00 to $50.00 list	25%	20%

TOASTERS, UPRIGHT

NEW YORK

List price	$6.00
Discount	30%

CHICAGO

List price	$6.00
Discount	30%

WIRE, ANNUNCIATOR

NET PRICE—NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0.44¼
No. 18, full spools	0.43¼

CHICAGO

	Per Lb. Net
No. 18, less than full spools.	$0.57½ to $0.65
No. 18, full spools	0.50 to 0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
11	$15.00-$18.00	$13.00	$10.25-$11.50
12	23.25- 25.41	21.30- 21.78	15.97- 19.35
10	32.40- 35.21	29.70- 30.18	22.13- 27.00
8	45.70- 49.12	41.90- 42.12	30.88- 38.00
6	72.40- 77.84	66.35- 66.72	48.93- 60.30

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14	$18.00	$13.00-$13.50	$11.50-$12.00
12	25.52-$25.69	22.02- 25.33	18.35- 20.93
10	36.48- 36.82	27.94- 31.26	22.86- 29.23
8	42.54- 51.73	38.99- 44.13	31.90- 41.36
6	67.38- 81.83	56.15- 75.61	50.50- 70.70

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 8 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	$33.25 to $35.25
25 to 50 lb.	31.25
50 to 100 lb.	28.25 to 34.25

CHICAGO

	Per 100 Lb. Net
Less than 25 lb.	$35.50 to $40.00
25 to 50 lb.	34.50 to 39.00
50 to 100 lb.	33.50 to 38.00

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Industrial Lighting Fixtures

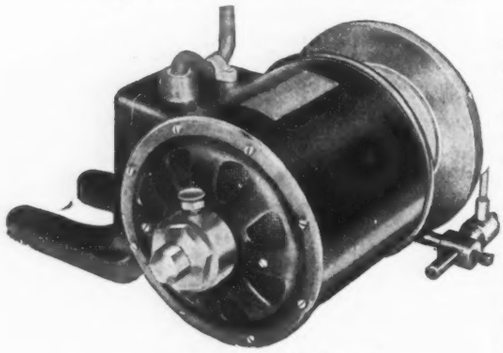
The Luminous Unit Company of St. Louis, Mo., has developed the industrial light shown herewith, which is made in sizes to accommodate lamps ranging from 100 watts to 1000 watts. It is said that this unit is scientifically cor-

ADAPTABLE TO PRESENT LIGHTING EQUIPMENTS

rect in design, making possible high physical efficiency and at the same time eliminating all objectionable glare. This fixture is composed of two elements, an upper element of white porcelain enameled steel and a white porcelain enameled-steel reflecting cone suspended below the upper reflector in such a manner that all light above the angle of 40 deg. is intercepted and reflected to the working plane. This fixture can be attached to any socket in a minute and is adaptable to present lighting equipments.

Tool-Post Grinder

Gilfillan Brothers Smelting & Refining Company of Los Angeles, Cal., is manufacturing a tool-post grinder adapted for use on lathes. An angle

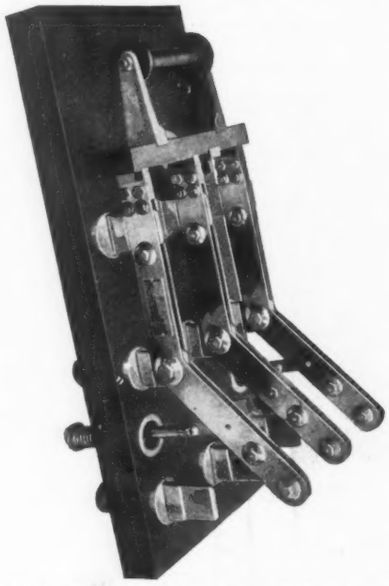


FOR USE ON LATHES

plate can be clamped around the tool post. There is a vertical adjustment of the grinder provided. This grinder is equipped with a Westinghouse ¼-hp. motor running at 3400 r.p.m. It is provided with a 6-in. by ⅜-in. (15.2-cm. by 0.9-cm.) grinding wheel, an extension mandrel for internal grinding fitted with a 1½-in. by ⅜-in. (3.8-cm. by 0.9-cm.) wheel, a tooth rest for cutter grinding and an electric attachment plug with 7½ ft. (2.3 m.) of cord.

Automatic Knife Switch

The Electrical Engineers' Equipment Company of Chicago is now manufacturing a line of automatic knife switches. The switch proper is constructed according to the company's standard design, having double blades which are driven home over clip contacts, spring washers being employed to secure proper contacting. Normally

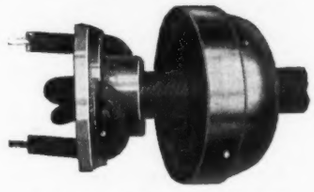


WELL ADAPTED WHERE CONTINUITY OF ENERGY IS IMPORTANT

the switch is closed into the upper contacts. These contacts are supplied from the customary source of power. In case this supply is interrupted a low-voltage coil operates, releasing springs which throw the switch blades into the lower row of contacts. These latter contacts are supplied from some independent source of power. When the normal source of energy is restored a bell alarm is sounded which is a signal for the attendant that the switch should be thrown manually into the upper contacts. The maker says that this type of switch is well adapted for use where continuity of energy supply is important. While the switch shown herewith is a 300-amp., 110-volt type, it can be made for all kinds of service.

Keyless Socket

Especially in millwork, it is frequently helpful to take advantage of the opportunity to place a larger number of lamps per circuit than the code permits for general wiring. In order to provide a keyless socket for pendent



FOR PENDENT DROP LIGHTS

drop lights wired with No. 14 portable cord, the Bryant Electric Company of Bridgeport, Conn., has added to its line of "New Wrinkle" socket caps one having a strain relief porcelain bushing with ½-in. (1.3-cm.) hole. The catalog designation of this socket cap is CB. When used in connection with the Bryant Company's No. 13 "New Wrinkle" keyless socket body, it provides a device that meets the conditions contemplated by rule 23-D as to inspection departments, the contractor and the customer.

Motor-Operated Therapeutic Machine

The Sanitarium Equipment Company of Battle Creek, Mich., has developed a motor-operated magneto which produces alternating current for medical purposes, including hydroelectric baths and automatic exercise. The equipment consists of an insulated table on which are mounted the driving motor, the magneto which generates the sinusoidal current, the interrupter, the speed and current controls and the connection posts.

A fractional-horsepower motor made by the General Electric Company is used. This drives the magneto through a leather-insulated friction disk. Speed is regulated and controlled by a hand screw which moves the motor on sliding-base rails to change the relative position of the friction disk on the motor shaft to the friction wheel on the generator or magneto shaft. The nearer the center of the disk the point of contact of the wheel, the slower the speed of the magneto.

Alternating current generated by the magneto is made and broken by a silent chain-drive interrupter which always acts at the same point in the wave in order to make the current painless. By the addition of a rotary converter on the magneto the cycles of the sin-

usoidal current all flow in the same direction, producing its characteristic waves.

This current is thoroughly insulated from that supplied to the motor via the lamp socket, and there is complete insulation to prevent the current supplied to the motor from reaching the patient.

Electrical Control for Calenders

A system of semi-automatic control for 115-230 volt, four-one-speed, double-voltage, shunt-wound motors for driving rubber calenders has been developed by the General Electric Company. The calender drive is operated through a master controller designed to give 115-volt or 230-volt operation with eighteen field points on each voltage for speed regulation.

Throwing the master controller in one direction starts the motor on 115 volts, and the field is automatically kept at full strength during acceleration. The accelerating contactors are of the series-current limit type and have a load pick-up to insure that they will come in on light loads. When the final accelerating contactor closes the motor will further accelerate to the full weakened speed at which the controller is set.

If a still higher speed is desirable, swinging the controller handle in the opposite direction will put the motor on the 230-volt line, where armature and field acceleration will occur as on the 115-volt line, eighteen additional speed points being now available. There is no objection to starting directly on 230 volts if the operator so desires. Bringing the controller to the "off" position will allow the motor to stop.

A "safety first" feature of the equipment is the "quick stop" device. This is a small inclosed switch with a lever arranged to be operated by a rope which runs across the calender where the workman can easily reach it. When this switch is pulled all line circuits are broken and the calender equipment is brought to a very quick stop by means of three-point dynamic braking. The calender drive cannot be started again until the stop switch is reset.

The entire system is extremely simple. There is not an electrical interlock on the control panel. This is an important feature, as in previous methods of control which utilized electrical interlocking the sulphur in the rubber mills formed a coating in the interlock contacts, which at times prevented them from making circuit. Mechanical interlocks are used in the new system and afford protection against the possibility of contactors sticking in. The accelerating contactors have a self-contained operating and calibrating coil, and the contactor is cut out after operating.

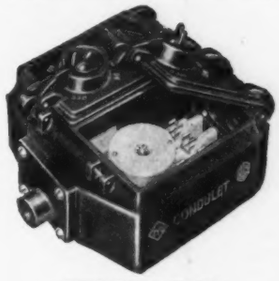
The motor used for the calender drive is the type RF motor, which is applied in sizes up to 75 hp. for single-voltage and 125 hp. for double-voltage equipments. Where the single-voltage system is used either automatic or semi-automatic control can be provided.

Small Motor Switches

Here is shown an illustration of one of two switch condulets of the ZY series —the latest addition to the line of conduit fittings manufactured by the Crouse Hinds Company of Syracuse, N. Y. It is claimed that these condulets protect the switch operator and the person renewing fuses from shock; they cannot be operated by accident; they withstand the roughest usage; water will not drain into them, and it is impossible for lint or other inflammable particles to lodge upon the current-carrying parts and thus create a fire hazard.

Both the body of the condulet and its cover are cast iron. Inside is a combined 20-amp. snap switch and fuse block. The switch is externally operated, and its handle interlocks with the latch of the door in such a way that the latter cannot be opened when the switch is in the "on" position. As a result of this arrangement the circuit is dead when the door is open and fuses can be replaced without danger of shock or short circuit.

As the machine operator or any other person not skilled in electricity



TWO-GANG FORM

can change fuses with perfect safety in ZY condulets, their use prevents all the loss in productive time which is unavoidable where an electrician must be sent for to replace fuses. This in the course of a year means a considerable saving in the operating time of the average mill.

The manufacturers list ZY condulets in one-gang and two-gang forms and in sizes and arrangements of threaded conduit hubs to meet various conduit wiring arrangements.

Quartz Mercury-Vapor Lamp for Ultra-Violet Light

An improved form of quartz mercury-vapor lamp which embodies new features in construction and application is manufactured by the R U V Company of New York City. This lamp produces an ultra-violet component several times stronger than that yielded by other forms of quartz-mercury vapor lamps. The wave lengths of its light have been measured as low as 0.18 μ, indicating a high degree of activity, it is claimed.

The lamp has an exceptionally clear crystal-quartz frame containing mercury, fitted at each end with terminals and provided with an unusually high vacuum. The cathode terminal of the lamp under running conditions contains practically all of the mercury, as the pressure built up in the luminous tube forces the mercury back into the cathode end. The anode end is fitted with a tungsten terminal that is refined to a point approaching 100 per cent purity in order to prevent discoloration of the luminous tube.

This type of lamp is known as the "hot anode" type and differs from all other designs in that no mercury chamber is used at the anode end. This feature permits of operation of the lamp in any plane from vertical to horizontal, and therefore permits of application to practically any equipment used by the chemical manufacturer.

To support the mercury-vapor arc, as in the case of all mercury-vapor arcs ballast resistance is required, and such resistance is placed in series. When the lamp is started cold, about 20 ohms resistance is placed in series, but when the lamp is normally operating one-half of this resistance is cut out so that normally 10 ohms is constantly in series with the lamp terminals. This cutting out of resistance is accomplished automatically on a small switchboard that is provided as an accessory.

The starting characteristics of the lamp are therefore 8.5 amp. at 220 volts direct current, which is required normally for 10 to 15 minutes. As soon as the starting resistance of 10 ohms is cut out, the lamp, then being in normal running condition, consumes 3.5 amp. at 220 volts direct current.

Convenient Current Transformer

In towns where construction men are not familiar with "wiped" joints on ornamental lighting circuits the new General Electric current transformer for series circuits, with a union joint, is a great convenience. With the transformer it is not necessary to "wipe" the joints inclosing the gap between the lead sheath of the underground cable and the sleeves surrounding the cable

PROVIDED WITH STRONG UNION JOINT

going from the transformer. This device is provided with a strong union joint which, when screwed up tight, is entirely waterproof.

Trade Notes

THE BABCOCK & WILCOX COMPANY of New York City has removed its Boston office from 35 to 49 Federal Street.

THE METROPOLITAN ENGINEERING COMPANY of Brooklyn, N. Y., has moved from New York City to 1250 Atlantic Avenue, Brooklyn, N. Y.

THE C. W. HUNT COMPANY, INC., manufacturer of coal-shoveling machinery, New York City, has removed its offices from 45 Broadway, to the Astor Trust Building, 501 Fifth Avenue.

THE MARRON MANUFACTURING COMPANY of Rock Island, Ill., has absorbed the Trio Manufacturing Company, which has been making a line of approved knife switches for years.

THE LIGHTOLIER COMPANY of New York City on Feb. 15 became the name of the New York Gas & Electric Appliance Company. All goods that it manufactures will be sold under the registered trademark of "Lightoliers."

THE DEPARTMENT OF COMMERCE of Washington, D. C., has published "Foreign Tariff Notes," No. 26, issued by the Bureau of Foreign and Domestic Commerce. The pamphlet has a special chapter on "Effect of the War on Tariff Policies."

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, East Pittsburgh, Pa., announces the removal of its branch office from Phoenix to Tucson, Ariz. J. H. Knost and W. G. Wilson, the company's representatives, will have headquarters in the Immigration Building.

THE H. C. ROBERTS ELECTRIC SUPPLY COMPANY of Philadelphia, manufacturer of electrical supplies, has completed the removal of its establishment from 905 Arch Street to the new five-story building at the corner of Eleventh and Race Streets. The new location provides for increased capacity.

FRED WILMARTH will represent the Greusol-Quarfot Electric Company of Milwaukee, Wis., in northern Illinois and southern Wisconsin, with headquarters at Rockford, Ill. Frank W. Greusol, president of the company, who has looked after this territory heretofore, will remain at the home office.

THE H. W. JOHNS-MANVILLE COMPANY of New York City has opened a branch house in its new building, corner of Olive and Eleventh Streets, St. Louis, Mo. It is a six-story structure of modern fireproof construction. Whenever practicable the company's products were used in the finishing of the building.

THE SWAN & FINCH COMPANY of New York City has just celebrated its sixty-fifth birthday, having started in February, 1853, in a small way. At the present day the company has classified 103 industries in which one or more of its products are used. Its main plant at Bayway, N. J., covers more than 15 acres.

J. HOWARD SANDIDGE, who has been employed in the Chicago office of the Cooper Hewitt Company, has opened an office for that company in Milwaukee, with headquarters at 1011 Majestic Building. This change has been made in order to cultivate more intensively a territory with which Mr. Sandidge is familiar.

THE ESTERLINE COMPANY of Indianapolis, Ind., announces the appointment of the Northern Electric Company, whose main office is at Montreal, as exclusive distributer of Esterline products for the entire Dominion of Canada. The Northern company has branch offices in Halifax, Ottawa, Toronto, London, Winnipeg, Calgary and Vancouver.

THE DRIVER-HARRIS COMPANY of Harrison, N. J., regrets to announce the death of its treasurer, George J. Althen, on Feb. 15. Mr. Althen for the past four years had been connected with the company and was well known on account of his affiliation with the National Credit Men's Association. He represented New Jersey on the executive committee of that body.

THE NATIONAL LAMP WORKS OF THE GENERAL ELECTRIC COMPANY has purchased the automobile plant and land of the Abbott Corporation at Cleveland, Ohio, which is now in financial trouble. The plant is at One Hundred and Fifty-second Street and the Nickel Plate Railroad Company tracks. The consideration was about $200,000. The deal includes a one-story building, 110 ft. by 681 ft., and five acres of land.

L. K. COMSTOCK & COMPANY, contracting engineers, announce the establishment of an office in the Union Trust Building, Washington, D. C. This action is taken by the Comstock company for the purpose of co-operating with the various government departments and general contractors in the execution of electrical and mechanical installations arising out of the government war construction program. E. E. van Cleef and G. E. Stewart will be located in Washington for the purpose of rendering service to the various departments and contractors.

THE CUTLER-HAMMER MANUFACTURING COMPANY, Milwaukee, Wis., to insure service and every possible assistance to the various departments of the United States government, has arranged to station H. W. Knowles of its New York office permanently in Washington for the period of the war. Mr. Knowles entered the service of the Cutler-Hammer company shortly after being graduated from Cornell University in 1912. He spent nearly five years in the shop, engineering and sales department at Milwaukee. Since May of last year he has been connected with the New York district office. The Washington branch will have its headquarters at the Bradford, Eighteenth and K Streets.

New Incorporations

THE GARDEN CITY (KAN.) POWER COMPANY has been incorporated with a capital stock of $750,000 by J. P. Nolan, F. A. Gillespie and J. S. McNamara.

THE SOUTHWESTERN ELECTRIC COMPANY of Tulsa, Okla., has been chartered with a capital stock of $3,000 by C. D. Shamel, H. D. Maxwell and R. W. Shamel.

THE SHERIDAN STORAGE BATTERY COMPANY of Creston, Iowa, has been incorporated with a capital stock of $20,000. The officers of the company are: L. J. Sheridan, president, and Harold Davis, secretary.

THE CENTRAL KENTUCKY LIGHTING & POWER COMPANY of Lexington, Ky., has been incorporated by E. L. Uncapher of Cincinnati, Ohio; W. I. Katterjohn of Paducah and Edward Johnson of Lexington, Ky.

THE CUMBERLAND ELECTRIC MANUFACTURING COMPANY of Memphis, Tenn., has been incorporated with a capital stock of $6,000 to manufacture electrical supplies, etc. The incorporators are: M. W. Wilson, H. A. Beckmann and others.

THE AMERICAN BURGLAR ALARM COMPANY of Buffalo, N. Y., has been chartered with a capital stock of $10,000 by C. J. and William Stroke of Buffalo. The company proposes to manufacture electric burglar alarms and kindred products.

THE THORP (WIS.) ELECTRIC LIGHT & POWER COMPANY has been chartered with a capital stock of $10,000 by P. D. Kline, Donald Boyd and E. C. Dearth. The company proposes to take over the municipal electric-light plant in Thorp and enlarge same.

THE WEST SIDE EIECTRIC CONTRACTING COMPANY of New York, N. Y., has been incorporated by Samuel Berkowitz, S. Berkowitz and E. Jacobson. The company is capitalized at $1,000 and proposes to do a general electrical contracting business.

THE WEBSTER ELECTRIC COMPANY of Racine, Wis., has been chartered by Walter Brown, P. G. Crewe and John B. Simmons. The company is capitalized at $600,000 and proposes to manufacture small electric motors and electrically driven devices and appliances.

THE CUMBERLAND ELECTRIC MANUFACTURING COMPANY of Memphis, Tenn., has been incorporated by M. W. Nelson, H. A. Beckham, E. L. Nelson, J. S. Nelson and William C. Burton. The company is capitalized at $6,000 and proposes to manufacture electrical supplies.

THE LOWENSTEIN RADIO COMPANY of New York, N. Y., has been incorporated with a capital stock of $500,000 by F. Lowenstein, 397 Bridge Street, Brooklyn, N. Y.; H. G. Wilson, 233 Broadway, New York, N. Y., and A. Harris of Newark, N. J. The company proposes to manufacture wireless apparatus.

THE COLE STORAGE BATTERY COMPANY of Chicago, Ill., has been incorporated with a capital stock of $100,000 by William Navigate, Samuel Goldfarb and H. A. Silverstein, all of Chicago, Ill. The company is capitalized at $100,000 and proposes to do business in storage batteries and other kinds of batteries.

Trade Publications

LAMP GUARDS.—Harvey Hubbell, Inc., of Bridgeport, Conn., has prepared a leaflet descriptive of its Hubbell lamp guard.

LINE SPECIALTIES.—W. N. Matthews & Bro., Inc., of St. Louis, Mo., is distributing a catalog descriptive of its line-material specialties.

HEADLIGHTS.—The Ohio Brass Company, Mansfield, Ohio, has prepared a folder descriptive of its luminous and incandescent type of headlights.

FOREIGN TRADE INFORMATION.—The American Express Company of New York City has prepared a booklet descriptive of its foreign trade information.

TELEPHONE BRACKET.—The Northern Electric Company of Minneapolis, Minn., is distributing a leaflet descriptive of the Burns adjustable telephone bracket.

PUMPING UNITS.—The Allis-Chalmers Manufacturing Company of Milwaukee, Wis., has prepared a circular descriptive of its type "S" centrifugal pumping unit.

CIRCUIT BREAKERS.—The Roller-Smith Company, 233 Broadway, New York City, has prepared bulletin No. 500, descriptive of its inclosed type plain no-voltage circuit breakers.

FANS.—Century alternating-current stationary and oscillating desk and bracket fans are illustrated and described in a circular prepared by the Century Electric Company of St. Louis, Mo.

DISCONNECTING HANGERS. — The Thompson Electric Company, 5606 Euclid Avenue, Cleveland, Ohio, has prepared catalog B-17, descriptive of its Thompson safety disconnecting hangers.

DIES.—The Wells self-opening die is illustrated and described in a bulletin prepared by the Greenfield Tap & Die Corporation of Greenfield, Mass. The advantages of self-opening dies are pointed out.

REFLECTORS AND FIXTURES.—The George Cutter Company of South Bend, Ind., is distributing bulletin No. 3337, descriptive of its Sol-Lux industrial lighting reflectors and fixtures. This bulletin takes up the value of good industrial lighting, describes holder sockets, reflectors, industrial lighting reflectors, reflecto-cap diffusers, one-piece reflectors, pendent fixtures, bracket fixtures and sign lights. This company has also prepared bulletin No. 3338, descriptive of its universal and standard flood-lighting projectors.

AMMONIA COMPRESSOR.—The De La Vergne Machine Company of New York City has prepared an attractive bulletin entitled "Ammonia Compressor Capacity." In this bulletin it is pointed out that 222 new-style vertical safety compressors of this company's make have been installed in place of old compressors during four years. A few letters from satisfied customers are appended. This company has also prepared a bulletin descriptive of its counter-current ammonia condenser, including information regarding two batteries of ammonia condensers at the plant of Wilson & Company, New York City.

SAFETY-SWITCH BULLETIN.—Safety auto-lock switches are described and illustrated in some detail in special publication No. 1585-A, just issued by the Krantz Manufacturing Company, Inc., of Brooklyn, N. Y. These switches are designed for use on circuits wherever the ordinary knife switch may be applied. They are especially designed for safety, it being absolutely impossible to touch the live parts regardless of the position of the switch or of the door. They are particularly adapted for use in steel mills, factories, mines and other similar locations where men are employed who have no practical knowledge of electricity.

CONDENSATION UTILITIES. — The Farnsworth Company of Conshohocken, Pa. has prepared an illustrated bulletin descriptive of its condensation utilities. The following apparatus are described: Duplex boiler feeder, duplex condenser-vacuum boiler-feed pump, duplex pumping trap, duplex condenser-vacuum pumping trap, direct-return condenser-vacuum trap, direct-return trap, pumping trap condenser-vacuum pumping trap, high-vacuum trap, separating or non-return trap, variable-pressure trap or combined pumping and non-return or separating trap, and variable-pressure condenser-vacuum pumping and separating trap. A chart showing the coal which can be saved by increasing the temperatures of the feed water by using the machines made by this company with closed system, or keeping the condensation under pressure, is given.

New England States

BRATTLEBORO, VT.—The Public Service Commission has granted the Twin State Gas & Electric Company permission to issue $40,000 in bonds to cover extension of transmission lines in Brattleboro, Bennington and St. Johnsbury, and for improvements at its West Dummerstown power plant.

ADAMS, MASS.—The Renfrew Manufacturing Company is contemplating the construction of a power plant to supply electricity to operate its several mills. The proposed plant, it is reported, will be erected on Columbia Street, on the site now occupied by the old Broadley mill, from which electricity would be transmitted to the main mill in Renfrew and to those in the Maple Grove district of the town.

NEW HAVEN, CONN. — A new power plant is being erected at the plant of the Marlin Arms Corporation, Willow Street, in connection with the construction of a new factory building. Frederick T. Ley & Company of Springfield, Mass., has the contract.

Middle Atlantic States

AVERNE, N. Y.—Walter H. Goehagen, Inc., 147 Remsen Street, Brooklyn, is planning to construct a shipbuilding plant at Averne, including erection of one-story machine shop, 200 ft. by 300 ft., a wood-working shop and saw mill, 200 ft. by 300 ft., boiler house, etc., to cost about $100,000.

BUFFALO, N. Y.—The City Council has authorized George H. Norton, city engineer, to engage a consulting engineer to report on the feasibility of constructing a hydroelectric power plant near Niagara Falls for the city, to cost about $1,000,000.

BUFFALO, N. Y. — Arrangements have been made by the Westinghouse Electric & Manufacturing Company for the lease of the factory building, located at Milton and Harrison Streets, formerly occupied by the Standard Mirror Company. This building will replace the plant of the company on Locke Street, recently destroyed by fire.

JAMESTOWN, N. Y.—The erection of an electric power plant on the Jamestown Cotton Mills property is under consideration by the Crescent Tool Company. The present plans provide for the installation of a 1000-kw. turbo-generator; electricity to be transmitted to the main plant at the corner of Harrison Street and Foote Avenue, which is now operated by gas (natural) engine power.

NEW YORK, N. Y.—Contract has been awarded by Kyle & Purdy, 282 King Avenue, City Island, ship and boat builder, for a three-story addition to its plant on Fordham Street, 60 ft. by 180 ft., and the erection of a boiler house, 30 ft. by 50 ft.

NEW YORK, N. Y.—Plans have been prepared by H. Harlach, 451 East 144th Street, for an addition to the boiler house of the Arabol Manufacturing Company, 100 William Street, New York City, on Sanford Street, near Flushing Avenue, Brooklyn.

HARRISON, N. J.—The Driver-Harris Company is contemplating rebuilding its plant recently destroyed by fire. Two buildings, one three stories, 40 ft. by 200 ft., and the other 25 ft. by 100 ft., will be erected. The company manufactures wire and wire products.

JERSEY CITY, N. J.—Recommendations have been made to the City Commission by the Department of Public Safety, Roger Boyle, fire chief, providing for extensive improvements to the fire alarm system, which include the installation of underground conduits to replace overhead wires, installation of gong circuits, to remove all fire houses from box or street circuits; installing an auxiliary switchboard, and the installation of new fire alarm systems in all school buildings.

NEWARK, N. J.—The contract for the installation of electrical work for large warehouses and port terminals to be erected at Newark, N. J., by the United States government has been awarded to the Bland Electric Company of Louisville, Ky.

SUMMIT, N. J.—Plans are being considered by the Commonwealth Water Company of Summit for the installation of a steam-turbine centrifugal type pumping unit having a daily capacity of 1,000,000,000 gal., at its Canoebrook pumping station. Frank C. Kimball is general manager.

CHESTER, PA.—To meet the increasing demand for power service the Delaware County Electric Company, controlled by the Philadelphia Electric Company, is constructing a large steam power station in Chester on the Delaware River. The new station is designed for an ultimate output of 120,000 kw., of which it is expected that the initial 60,000-kw. unit will be in operation by Aug. 1, 1918. This plant will supply energy to the United States government shipyards at Hog Island, now under construction and in partial operation.

LEBANON, PA.—Preparations are being made by the Metropolitan Edison Company of Reading for the installation of a new rotary converter at its local plant.

PHILADELPHIA, PA.—Plans have been prepared for the construction of a new power house, 50 ft. by 60 ft., at 2626 Martha Street for the Cocoa Butter Manufacturing Company. Andrew J. Sauer & Company of Philadelphia are architects.

PITTSBURGH, PA. — Plans have been prepared for the installation of electrical, switchboard and heating apparatus in the proposed new five-story factory building of the Pennsylvania Chocolate Company.

CHARLESTON, W. VA.—The construction of a termnial station on Kanawha Street is under consideration by the Charleston-Dunbar Traction Company.

FIRECO, W. VA.—The Battleship Coal Company of Princeton, recently incorporated with a capital stock of $150,000, contemplates the installation of a central electric power plant in connection with a coal and coke mining camp at Fireco. The project includes the erection of 50 houses for miners. H. E. Hines is president.

WASHINGTON, D. C. — Contract has been awarded by the Bureau of Yards and Docks, Navy Department, Washington, for the construction of a new one-story boiler shop, 100 ft. by 200 ft., at the Washington Navy Yard, to cost about $81,100.

WASHINGTON, D. C.—Plans have been prepared by the Bureau of Yards and Docks, Navy Department, Washington, for the construction of a new substation and frequency changer house at the Washington Navy Yard, to cost about $200,000.

WASHINGTON, D. C. — Contract has been awarded by the Bureau of Standards, Department of Commerce, Washington, D. C., to the Turner Construction Company for the construction of an industrial testing laboratory, 167 ft. by 350 ft., four stories, with two courts, 85 ft. by 107 ft., to cost about $630,000.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until March 4 for furnishing and installing two 220-ton, one 100-ton, three 25-ton, three 20-ton, nine 15-ton, one 10-ton and two 5-ton overhead electric traveling bridge cranes at the navy yard, Washington, D. C. Drawings and specifications (No. 2775) may be obtained on application to the above bureau or to the commandant of the navy yard named.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

North Central States

CLEVELAND, OHIO. — The Cleveland Electric Illuminating Company, it is reported, will build an addition, 105 ft. by 161 ft., to its power house on East Seventieth Street. New equipment, including a 25,000-kw. turbine, will be installed.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleveland, Ohio, until March 8 for station transformers for the division of light and heat. Specifications may be obtained at the office of division of light and heat.

FLOODWOOD, OHIO.—The Central Electric Producing Company of Athens has started work on the installation of new equipment at its plant as follows: Additional boilers of 2000 hp., three 2500-kw., 2300-volt General Electric turbo-generators, with necessary transformers, switching apparatus and other accessories. J. T. Magruder of Nelsonville is superintendent of overhead distribution.

MANSFIELD, OHIO.—Negotiations have been closed whereby the Westinghouse Electric & Manufacturing Company has leased the plant of the Baxter Stove Company in Mansfield. The Westinghouse Company will take possession of the property immediately and will expend from $20,000 to $25,000 to equip the plant for the manufacture of electric ranges, electric heating stoves, electrical cooking devices, appliances, etc.

MARION, OHIO.—The Columbus, Delaware & Marion Electric Railway, it is reported, will ask the city of Marion for a new 25-year franchise for the operation of the local electric-light plant and street railway system. Improvements involving an expenditure of about $1,000,000 will be made to the power station and street railway system. Bonds to the amount of $7,000,000 will be issued for improvements to the entire property, including the interurban road.

TOLEDO, OHIO. — The Toledo Electric Steel Company, it is reported, will construct a plant, 92 ft. by 350 ft., for the manufacture of high-speed and carbon tool steel. D. E. Rowe is president.

GREENVILLE, KY. — Plans are being prepared for the construction of a new central power plant, about 65 ft. by 80 ft., at the works of the W. G. Duncan Coal Company. Charles M. Means, Oliver Building, Pittsburgh, Pa., is consulting engineer.

RICHMOND, IND.—James P. Dillon, superintendent of the municipal electric-light and power plant, has made formal request to the City Council for an appropriation of $200,000 for extensions to the municipal electric-light plant. Owing to the coal shortage several manufacturing plants are considering abandoning steam power next winter, provided the city can furnish the necessary electrical service.

GREAT LAKES, ILL.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until March 11 for construction of three brick buildings, including heating, electric-lighting and plumbing systems, at the Naval Training Station, Great Lakes, Ill., under specifications (No. 2816), as follows: A two-story radio quarters, about 46 ft. by 28 ft.; a two-story residence, about 26 ft. by 42 ft., and a post office building, 73 ft. by 48 ft. Drawings and specifications may be obtained on application at the above office or to the commandant of the naval station named.

HARRISBURG, ILL.—The Illinois Public Utilities Commission has authorized the Central Illinois Public Service Company of Mattoon to purchase the plant and property of the Southern Illinois Railway & Power Company of Harrisburg.

STEWARDSON, ILL.—Steps have been taken for the installation of a joint electric lighting plant with Strassburg. A company is being organized with a capital stock of $35,000 to operate the proposed plant. Energy will be secured from the high-tension lines of the Central Illinois Service Company at Windsor. Stewardson already has an electric plant, but Strassburg is without lighting facilities.

MENOMONIE, WIS.—Estimates, it is reported, are being received by Thomas L. Thorson, mechanical engineer, Menomonie, for the construction of the proposed cooperative central steam heating plant at Menomonie, consisting of a brick and concrete building, 114 ft. by 174 ft., equipped with eight 1200-hp. boilers, with provision for four additional boilers, pump room, power room and coal bunkers equipped with automatic stokers, coal-handling apparatus, ash conveyors, vacuum system, etc. The initial installation will have a capacity of 1800 hp. and provide a radiation of from 350,000 to 400,000 sq. ft. Electric equipment may also be installed in connection with this plant and exhaust steam and electricity both be used for heating.

NEW LONDON, WIS.—Preparations, it is reported, are being made by Albert M. Mayo & Company of New London, to reopen the wood-working plant, formerly owned by Kenkel Manufacturing Company. A new 100-hp. motor-generator set will be installed. Electricity from the municipal electric-light plant will be utilized.

REEDSBURG, WIS.—Improvements are contemplated to the municipal electric-light plant, including the installation of a new electric generating unit of 250 or 300 kw., directly connected to either a uniflow engine or a steam turbine, this summer. Otto F. Luepke is superintendent.

THORP, WIS.—The Thorp Electric Light & Power Company, recently incorporated with a capital stock of $10,000, will take over the local municipal electric plant. The new owners, it is understood, will enlarge plant and improve the system. P. D. Kline is one of the incorporators.

BEMIDJI, MINN.—Bids will be received by the Minnesota State Board of Control, State Capitol Building, St. Paul, until March 12 for the construction of the State Normal School Building, including the general contract work, heating and ventilating, plumbing and electrical work. Separate bids to be submitted on each division of the work. Copies of plans and specifications may be obtained upon application to C. H. Johnson, architect, 715 Capital Bank Building, St. Paul.

CEDAR RAPIDS, IOWA.—Bids will be received by the Board of Education, Cedar

Rapids, until March 14, for the construction of a high school building, including hot water heating, electric wiring, plumbing, vacuum cleaner, etc. The cost of the building is estimated at $75,000. K. T. Snyder, 933 Plymouth Building, Minneapolis, Minn., is architect.

CONCORDIA, MO.—Plans are being considered by the trustees of St. Paul's College for the construction of a new power plant at the institution. Charles F. May, Merchants' Laclede Building, St. Louis, is architect.

GREGORY LANDING, MO.—The installation of a pumping plant, to cost $75,000, exclusive of building, is contemplated by the Gregory Drainage District. Edmund T. Perkins, Illinois State Bank Building, Quincy, Ill., is engineer.

META, MO.—The installation of an electric-light plant in Meta is reported to be under consideration. Fritz Schallert is said to be interested.

ST. LOUIS, MO.—The St. Louis Malleable Castings Company is planning extensions to its plant, including the erection of a machine shop, forge shop, foundry, electric power plant, etc.

FARGO, N. D.—Bids will be received by the Board of Education of Fargo, N. D., until March 25 for the construction of a new high school building. Plans and specifications may be obtained on application to William B. Ittner, architect, Board of Education Building, St. Louis, Mo. A deposit of $50 will be required for plans covering the general work and a deposit of $20 for plans for electric work.

UPLAND, NEB.—Preparations are being made for the installation of a municipal electric-light plant, to cost about $6,500, for which bids have been received.

FORT RILEY, KAN.—The local substation of the Union Light & Power Company of Junction City was recently destroyed by fire, causing a loss of about $10,000.

LAWRENCE, KAN. — The Bowerstock Mills & Power Company, it is reported, contemplates the construction of a large boiler house soon. The company supplies energy to the Kansas Electric Utilities Company of Emporia to operate the local system.

OTTAWA, KAN. — The City Council is contemplating extending the electric transmission line on South Willow Street from Eleventh to Fifteenth Street, and then east in Fifteenth from Willow to Locust Street.

PITTSBURG, KAN. — Bids will be received by the Sisters of St. Joseph, care of Sister Superior Martini, Pittsburg, for construction of addition to the Mount Carmel Hospital, to cost about $100,000. Separate bids to be submitted on heating, electric wiring, electric or hand power elevator, vacuum cleaner, plumbing, etc. G. W. Van Meter, 504 Caldwell-Murdock Block, Wichita, is architect.

POTWIN, KAN.—The City Council has adopted an ordinance granting the Kansas Gas & Electric Company of Wichita a franchise to install and operate an electric lighting, power and heating plant or a distributing system in Potwin.

Southern States

DUNN, N. C.—The General Utility Company, recently incorporated, is planning to install an electric plant, to cost about $25,000. As yet an engineer has not been engaged. B. O. Townsend, Marvin L. Wade and G. M. Tilghman are interested.

CHARLESTON, S. C. — The Charleston Consolidated Railway & Light Company is considering increasing the output of its Meeting Street power house.

SPARTANBURG, S. C.—Plans are being considered by the South Carolina Light, Power & Street Railway Company for the construction of a new branch line to Camp Wadsworth, to cost about $300,000.

SAVANNAH, GA.—The County Commissioners have granted the Chatham County Traction Company a franchise to construct and operate an electric railway from Stiles Avenue, on the Augusta Road, to the Brampton tract of the Foundation Shipbuilding Company.

HUMBOLDT, TENN. — Improvements will be made to the municipal electric-light plant, including the installation of a 300-kw. General Electric turbine, together with a Westinghouse La Blanc condenser and auxiliaries, about Aug. 1, 1918. W. M. Case is secretary and general manager.

NASHVILLE, TENN. — The Welch-Millard Company of Nashville would like to receive prices, etc., on second-hand drills and electrically driven pumps and a 60-kw. to 100-kw. generator with boiler and engine for delivery in 60 or 90 days.

MUSCLE SHOALS, ALA. — President Wilson has signed an order authorizing the construction of a power dam at Muscle Shoals as part of the $60,000,000 project for a government plant there for the fixation of atmospheric nitrogen for the use in the manufacture of munitions and fertilizer. The dam site has been offered to the government without cost by the Alabama Power Company, which has also agreed to transfer options on about 75 per cent of the land which would be affected by the overflow from the dam.

CONWAY, ARK.—The Council committee on light, heat and sewer systems has authorized E. W. Leverett, superintendent, to secure bids for the installation of a 150-hp. engine and generator for the municipal electric-light plant.

OAK GROVE, LA.—The Town Council of Oak Grove will accept proposals for thirty days for the installation of an electric-lighting plant and will issue franchise to parties with best plant and inducements. For further information address L. Grathwell of Oak Grove.

BLACKWELL, OKLA.—At an election to be held March 5 the proposal to issue $82,500 for extensions to the municipal electric-lighting plant, $77,500 for extending water-works system and $15,000 for the purchase of fire-fighting apparatus will be submitted to the voters.

MADILL, OKLA.—The construction of a new plant in Madill is reported to be under consideration by the Consumers' Light & Power Company.

BOWIE, TEX.—An issue of $15,000 in electric-light bonds has been approved by the Attorney General.

GRAPEVINE, TEX.—The Grapevine Light & Ice Company will install an entire new plant some time during 1918. It is proposed to enlarge the entire system.

YOAKUM, TEX. — The Yoakum Power, Light & Water Company is contemplating increasing its boiler capacity, also building additional water lines and installing additional water meters. John A. Donaldson is superintendent.

Pacific and Mountain States

BELLINGHAM, WASH. — The Puget Sound Traction, Light & Power Company is contemplating the erection of an electric transmission line to the Cokedale Mine to furnish 500 hp. to the plant there.

FERNDALE, WASH.—The British Electric Company, it is reported, is considering extending its electric transmission lines to Ferndale to supply electricity here for lamps and motors. The company also proposes to furnish electrical service to farmers in the Glendale district.

POMEROY, WASH.—The City Council is considering an application of the Pacific Power & Light Company for a franchise to supply electricity for lamps and motors in Pomeroy for a period of 50 years.

SEATTLE, WASH.—The Board of Public Works has changed the date of opening bids for a completed new power plant from March 1 to March 15.

SEATTLE, WASH. — The City Building Department has decided to erect the proposed power substation for the city lighting department at Fourteenth Avenue Northwest and West Forty-ninth Street by day labor instead of letting a general contract. Bids for material and sub-contracts will be handled through the city purchasing agent. The plans call for a two-story reinforced concrete building, 55 ft. square. Daniel Huntington, architect, has supervision of construction work.

SPOKANE, WASH.—Contract, it is understood, has been awarded by the Washington Water Power Company for a third generator (22,500 hp.) for its Long Lake plant to the General Electric Company.

DEL MAR, CAL.—The State Railroad Commission has authorized the sale of the electric distributing system of the Del Mar Water, Light & Power Company to the San Diego (Cal.) Consolidated Gas & Electric Company, for a consideration of $11,055. The water system of the company is not included in the sale.

SACRAMENTO, CAL.—Application has been made to the Board of Supervisors of Sacramento by C. H. Slocum and R. A. Rose for a franchise to erect and operate an electric transmission line through Sacramento for a period of 50 years.

DUBOIS, IDAHO.—The Dubois Light & Power Company, recently incorporated with a capital stock of $25,000, is planning to construct an electric plant to furnish electrical service in Dubois. A power site has been purchased on Beaver Creek near Dubois, where a dam 46 ft. wide at the top and 26 ft. high, will be built.

SALT LAKE CITY, UTAH.—The city recorder has been instructed to advertise for bids for the installation of a special street-lighting system on Regent Street.

CHESTER, MONT.—Steps have been taken by local citizens to secure a better lighting system in Chester. It is proposed to have the Montana Power Company extend its service to the town.

HARLEM, MONT.—Bids will be received by the town clerk of Harlem until March 6 for the installation of an ornamental lighting system. Plans and specifications may be obtained on application to C. P. Wells, municipal engineer, Great Falls, Mont. Frank E. Meyer is town clerk.

COLORADO SPRINGS, COL.—The Golden Cycle Company is considering the construction of an electric power plant. At present the company secures electricity from the Colorado Springs Light, Heat & Power Company under a contract, which does not expire until 1920.

Canada

PRINCETON, B. C. — Work has been started on the extension of the West Kootenay Power Company's system across country from Greenwood to Princeton and Copper Mountain, a distance of more than 100 miles.

FRASERVILLE, ONT.—The City Council is considering a power development next summer in connection with the municipal electric-light plant and also other improvements to the system. E. Talbot is city clerk.

LONDON, ONT. — The London Electric Company, owned by the Mackenzie and Mann interests, it is reported, is planning to close down its power station on March 31. Unless taken over by the power controller the plant, it is said, will be scrapped.

MATTAWA, ONT.—The Mattawa Electric Light & Power Company is planning to make improvements to its waterwheel house this spring. T. H. Dougall is secretary and treasurer.

PARRY SOUND, ONT. — The city of Parry Sound is planning a 1500-hp. water power development in connection with the municipal electric-light plant as soon as conditions will permit. J. D. Broughton is treasurer.

ST. THOMAS, ONT.—A new distributing station was erected during 1917 for the municipal electric-lighting system, at a cost of $40,000. The arc lamps now in use will be replaced with incandescent street lamps this year. Orders have already been placed for the equipment. E. H. Coughell is manager.

TILSONBURG, ONT.—The erection of a new substation in the near future is under consideration by the Tilsonburg Hydro-Electric Commission. M. G. Dean is mayor.

MONTREAL, QUE.—Work, it is reported, has begun on an extension from the main line of the Grand Trunk Railway to the Military Hospital at Whitby. This line, it is stated, will be equipped for electrical operation and will ultimately form a part of the electric lines to be built under the plans of the Hydro-Electric Power Commission of Ontario.

THREE RIVERS, QUE.—The Page Wire Company of Canada of Walkerville, Ont., which proposes to erect a plant at Three Rivers at a cost of about $150,000, it is stated, will soon be in the market for equipment, including motors, etc.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until March 11, for iron or steel sheets, pipe straps, steel wire and cable, electrical switches, lighting projectors, copper cable, condenser tubes, etc. Blanks and information relating to this circular (No. 1201) may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 606 Common Street, New Orleans, La., and Fort Mason, San Francisco, Cal.

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until March 23 for furnishing generator sets, switchboards, copper cable, end bells, transformer connectors, terminals, receptacles, copper rod, busbar supports, pipe fittings and floor flanges. Blanks and general information relating to this circular (1203) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 606 Common Street, New Orleans, La., and Fort Mason, New Orleans, La.

Directory of Electrical Associations

Printed in the First Issue of Each Month

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co.

AMERICAN ASSOCIATION OF ENGINEERS. Secretary, A. H. Krom, 29 South La Salle St., Chicago. Annual meeting, May 14, 1918.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, E. B. Burritt, 8 West 40th St., New York.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS, INC. Secretary, F. A. Molitor, 35 Nassau St., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country.

AMERICAN PHYSICAL SOCIETY. Secretary, Prof. A. D. Cole, Ohio State University, Columbus, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary-treasurer, Edgar Marburg, University of Pennsylvania, Philadelphia.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Secretary-treasurer, Roy B. Fowles, Pine Bluff, Ark. Annual convention, Hot Springs, Ark., May 21-23.

ASSOCIATED MANUFACTURERS OF ELECTRICAL SUPPLIES. General secretary, C. E. Dustin, 30 East 42d St., New York.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, George C. Holberton, San Francisco, Cal.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, John F. Kelly, McKeesport, Pa. Annual convention September, 1918.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Joseph A. Andreucetti, Chicago & Northwestern Railway, Chicago.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, W. L. Connelly, Gibson, Ind.

BRITISH COLUMBIA ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary, R. B. W. Pirie, 406 Yorkshire Building, Vancouver, B. C. Annual meeting, September, 1918.

CALIFORNIA ASSOCIATION OF CONTRACTORS AND DEALERS. Secretary, James W. Redpath, 505 Rialto Bldg., San Francisco, Cal.

CANADIAN ELECTRICAL ASSOCIATION, affiliated with N. E. L. A. Secretary-treasurer, M. C. Gilman, Toronto Electric Light Company.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary-treasurer, T. F. Kennedy, 900 15th St., Denver, Col.

COMMERCIAL SECTION, N. E. L. A. Secretary, F. D. Beardslee, Union Electric Light & Power Co., St. Louis, Mo.

CONNECTICUT ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary, George M. Chapman, Waterbury, Conn. Annual meeting, New Haven, Conn., May, 1918.

EASTERN NEW YORK SECTION, N. E. L. A. Assistant secretary, J. L. Hemphill, General Electric Co., Schenectady, N. Y.

ELECTRICAL MANUFACTURERS' CLUB. Secretary, Shiras Morris, Hart & Hegeman, Hartford, Conn.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

ELECTRICAL CREDIT ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert E. Elliott, 502 Flatiron Building, San Francisco.

ELECTRIC POWER CLUB. Secretary, C. H. Roth, 1410 West Adams St., Chicago.

ELECTRIC VEHICLE SECTION OF THE N. E. L. A. Secretary, A. Jackson Marshall, 29 West 39th St., New York.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 29 West 39th St., New York.

FLORIDA ENGINEERING SOCIETY. Secretary, J. R. Benton, Gainsville, Fla.

GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION OF OKLAHOMA. Secretary-treasurer, L. W. W. Morrow, Norman, Okla. Annual meeting, May 1918, Oklahoma City.

GEORGIA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, Dan Carey, Atlanta Builders' Exchange, Atlanta, Ga. Annual meeting, June, 1918, Tybee Island, Ga.

ILLINOIS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, L. B. Van Nuys, Central Electric Co., Peoria, Ill.

ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary, R. H. Abbott, Petersburg, Ill.

ILLUMINATING ENGINEERING SOCIETY. General secretary, Clarence L. Law. Sections in New York, Philadelphia, Pittsburgh, Cleveland, Chicago and Boston.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Thomas Donahue, Lafayette, Ind.

INDIANA STATE ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, George Skillman, Indianapolis, Ind.

INDUSTRIAL ELECTRIC HEATING ASSOCIATION. Secretary, Homer Kunz, Toledo Railways & Light Co., Toledo, Ohio.

INSTITUTE OF RADIO ENGINEERS. Secretary, David Sarnoff, 111 Broadway, New York.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

IOWA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, M. T. Humphrey, Waterloo, Iowa.

IOWA SECTION, N. E. L. A. Secretary-treasurer, L. E. Caldwell, Iowa City, Iowa.

JOVIAN ORDER. Jupiter (president), Henry J. F. Strickland, Dallas, Tex.; Mercury (secretary), E. C. Bennett, Syndicate Trust Building, St. Louis, Mo.

KANSAS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, R. M. Sutton, Wichita.

KANSAS PUBLIC SERVICE ASSOCIATION. Secretary-treasurer, W. W. Austin, Cottonwood Falls, Kan. Annual meeting, Kansas City, Kan., Oct. 17-19, 1918.

KENTUCKY ASSOCIATION OF ELECTRICAL CONTRACTORS. Secretary, F. F. Valinoti. Annual meeting, May, 1918, Louisville, Ky.

LOUSIANA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, I. G. Marks, 323 Chartres St., New Orleans, La.

MAINE ELECTRIC ASSOCIATION. Secretary-treasurer, Walter S. Wyman, Augusta, Me.

MASSACHUSETTS ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary, J. E. Wilson, 263 Summer St., Boston, Mass.

MICHIGAN SECTION, N. E. L. A. Secretary, Herbert Silvester, Detroit Edison Co., Monroe, Mich.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary, H. E. Young, Minneapolis General Electric Company, Minneapolis, Minn.

MINNESOTA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, G. M. Jones, 112 South Seventh St., Minneapolis, Minn.

MISSISSIPPI ELECTRIC ASSOCIATION. Affiliated with the N. E. L. A. Secretary-treasurer, W. F. Wheeler, Hattiesburg.

MISSOURI ASSOCIATION OF PUBLIC UTILITIES. Secreatry-treasurer, F. D. Beardslee, Union Electric Light & Power Co., St. Louis.

MISSOURI ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary, A. J. Burns, 318 West Tenth St., Kansas City, Mo.

NATIONAL ARM, PIN AND BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary, H. C. Brown, 41 Martin Building, Utica, N. Y.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, William L. Smith, Concord, Mass. Annual convention, New York, March, 1918.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, 33 West 39th St., New York.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1350 Marquette Building, Chicago, Ill. Annual meeting, June 1, 1918.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

NEBRASKA SECTION, N. E. L. A. Secretary-treasurer, R. W. McGinnis, O'Neil Light & Creamery Co., O'Neil, Neb.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 15 State St., Boston, Mass.

NEW ENGLAND SECTION, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass.

NEW MEXICO ELECTRICAL ASSOCIATION. Secretary-treasurer, E. A. Thiele, Roswell.

NEW YORK ELECTRICAL CREDIT ASSOCIATON. Secretary, Franz Neilson, 120 Broadway, New York. Annual meeting, June, 1918.

NEW YORK ELECTRICAL SOCIETY. Secretary, George H. Guy, 29 West 39th St., New York.

NORTHWEST ELECTRIC LIGHT AND POWER ASSOCIATION. Affiliated with N. E. L. A. Secretary, George L. Myers, Pacific Power & Light Co., Portland, Ore. Annual meeting, Sept. 11, 1918.

NORTHERN WHITE CEDAR ASSOCIATION. Secretary, N. E. Boucher, 743 Lumber Exchange, Minneapolis, Minn.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus.

OREGON ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary-treasurer, J. W. Oberender, 302 Dekun Building, Portland, Ore. Annual meeting, September, 1918.

PACIFIC COAST SECTION, N. E. L. A. Secretary, A. H. Halloran, Crossley Building, San Francisco, Cal.

PENNSYLVANIA ELECTRIC ASSOCIATION. State Section N. E. L. A. Secretary, H. M. Stine, 211 Locust St., Harrisburg, Pa.

PENNSYLVANIA ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary, M. G. Sellers, 1518 Sansom St., Philadelphia.

PUBLIC SERVICE ASSOCIATION OF VIRGINIA. Secretary, W. J. Kehl, Virginia Railway & Power Co., Richmond, Va.

PUBLIC UTILITIES ASSOCIATION OF WEST VIRGINIA. Secretary, W. C. Davisson, West Virginia Water & Electric Co., Charleston.

RADIO CLUB OF AMERICA. Secretary, T. J. Styles, 152 Beach St., Yonkers, N. Y.

ROCKY MOUNTAIN ASSOCIATION OF MUNICIPAL ELECTRICIANS. President, Lawrence Stone, Denver, Col.

SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. General manager, J. M. Wakeman, 29 West 39th St., New York.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa. Annual meeting, Evanston, Ill., June, 1918.

SOUTH DAKOTA ELECTRICAL POWER ASSOCIATION. Secretary-treasurer, Frederick D. Brown, Huron, S. D.

SOUTHEASTERN SECTION, N. E. L. A. Secretary-treasurer, T. W. Peters, Columbus, Ga. Annual meeting, June 19-20, Atlanta.

SOUTHERN CALIFORNIA ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary-treasurer, J. E. Wilson, 425 Consolidated Realty Building, Los Angeles, Cal.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, H. S. Cooper, 403-4 Slaughter Building, Dallas, Tex. Annual convention, April 15-16, Galveston.

SOUTHWESTERN SOCIETY OF ENGINEERS. Secretary, C. E. Barglebaugh, 703 First National Bank Building, El Paso, Tex. Annual meeting, April, 1918.

TEXAS STATE ASSOCIATION OF ELECTRICAL CONTRACTORS. Secretary, H. S. Ashley, Fort Worth, Tex. Annual meeting, Galveston, Tex., June 15, 1918.

TORONTO ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, J. E. Myers, 3 Gould St., Toronto, Ont.

TRI-STATE WATER AND LIGHT ASSOCIATION. Secretary-treasurer, W. F. Steiglitz, Columbia, S. C. Annual meeting, Charlotte, N. C., April, 1918.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, C. H. West, Rutland, Vt. Annual meeting, February, 1918.

VIRGINIA STATE ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, E. M. Andrews, Richmond.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 175 W. Jackson Blvd., Chicago, Ill.

WESTERN SOCIETY OF ENGINEERS, ELECTRICAL SECTION. Secretary, E. S. Nethercut, 1735 Monadnock Block, Chicago.

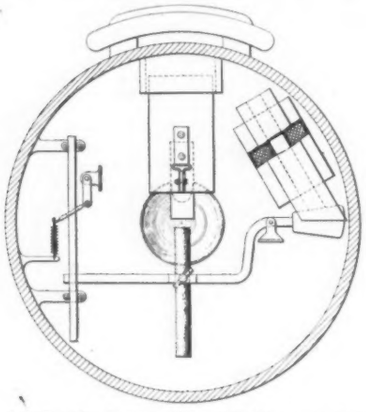
WISCONSIN ELECTRICAL ASSOCIATION. Secretary, George Allison, 1410 First National Bank Building, Milwaukee, Wis. Annual meeting, March 27-28, 1918, Milwaukee.

WISCONSIN ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary, J. C. Staff, 578 Jackson St., Milwaukee, Wis.

(Issued Jan. 29, 1918.)

1,254,939. Means and Method for Metering Electricity; Edmund O. Schweitzer, Chicago, Ill. App. filed March 6, 1916. Adaptable for use in the measurement of alternating-current supply and affording a basis for payment to the central-station company by the consumer for electrical energy furnished to and consumed by him.

1,254,954. Street Indicator for Street Cars; Adolf A. Winkler, Great Falls, Mont. App. filed Sept. 27, 1915. Relates to improvements in card, picture and sign exhibiting, and more specifically to street indicators for street cars.



1,255,445—Regulating Mechanism for Arc Lamp

1,255,026. Elevator Signaling System; Harry G. Lee, Tacoma, Wash. App. filed March 29, 1915. Improvements.

1,255,037. Lead-Wire Terminal; Bernard H. Oestricher, New York, N. Y. App. filed July 10, 1917. Improvement.

1,255,069. Ignition Device; Harry R. Van Deventer, Sumter, S. C. App. filed Sept. 18, 1917. Including electrodes, a magneto generator electrically connected thereto, and a tripped-spring-actuated mechanism for operating said generator.

1,255,084. Switch; William W. Dean, Chicago, Ill. App. filed Feb. 18, 1913. For telephone systems.

1,255,096. Electrolytic Apparatus; George F. Jaubert, Paris, France. App. filed July 26, 1917. For the electrolysis of compounds, water for instance, from which gases are produced and are to be collected separately.

1,255,119. Electrical Bond; Edwin S. Slick and Charles W. Parkhurst, Westmont Borough, Pa. App. filed April 29, 1915. Improvements.

(Issued Feb. 5, 1918.)

14,430 (reissue). Party-Line Telephone System; Henry Hovland, East Orange, N. J. App. filed Oct. 31, 1912. Improvements.

1,255,121. Pivotal Joint Between an Alternating-Current Electromagnet and Its Armature; Albert Aichele, Baden, Switzerland. App. filed Dec. 30, 1916. Improvements.

1,255,126. Electric Switch; Clarence A. Bates, Bridgeport, Conn. App. filed March 27, 1917. Two-way type.

1,255,139. Electrical Insulation; William T. Cushing, Milwaukee, Wis. App. filed Sept. 9, 1915. Relates to that class of materials employing an inert filler as a base and a varnish-like binder.

1,255,152. Electric Socket; Frederic P. Gates, Hartford, Conn. App. filed April 7, 1917. Applies particularly to extension sockets for candle fittings.

1,255,157. Electric Switch; Gilbert W. Goodridge, Bridgeport, Conn. App. filed Nov. 6, 1916. Means for cushioning the operation of the switch mechanism so as to lessen the noise usually incident to its operation.

1,255,175. Vacuum Cleaner; John B. Kellogg, Orange, N. J. App. filed July 10, 1916. Adapted to receive the inner end of a flexible hose to which a cleaning tool is attached.

1,255,176. Wall Receptacle for Vacuum Cleaning Apparatus; John B. Kellogg, Orange, N. J. App. filed Dec. 26, 1916. Embodies a quick-break switch suitable for directly interrupting the motor circuit of the suction cleaning apparatus.

1,255,180. Telephone System; Charles W. Keckler, Newark, N. J. App. filed April 26, 1917. Improved means for testing the busy or idle connection of a called telephone line.

Record of Electrical Patents

Notes on United States Patents

1,255,181. Flush Receptacle; Charles J. Klein, Milwaukee, Wis. App. filed Oct. 28, 1913. Receptacle and plugs therefor.

1,255,185. Adjustable Supporting Apparatus; William B. Lehmkuhl, Cambridge, Mass. App. filed July 13, 1916. Improvement.

1,255,197. Cell; John L. Malm, Denver, Col. App. filed April 26, 1915. Applies particularly to electrolytic cells utilized in treating metallic salts to drive off the gaseous anion and deposit the metal.

1,255,205. Brush Connection for Dynamo-Electric Machines; Charles P. Monto, Cleveland, Ohio. App. filed March 26, 1917. Flexible connections.

1,255,211. System for the Successive Amplification of Energies; Alexander McL. Nicolson, New York, N. Y. App. filed June 8, 1915. Improvements.

1,255,225. Electric Switch; Guy R. Radley, Milwaukee, Wis. App. filed Dec. 8, 1911. Method of disrupting the arcs produced between the switch contacts.

1,255,241. Compression-Operated Ignition Device; Warren F. Stanton, Pawtucket, R. I. App. filed June 24, 1916. For use in conjunction with internal-combustion engines, pumps and other devices.

1,255,242. Compression-Operated Ignition Device; Warren F. Stanton, Pawtucket, R. I. App. filed June 24, 1916. Improvements.

1,255,248. Swivel for Telephone Boxes; Alfred Toll, Kansas City, Mo. App. filed May 10, 1915. Device for facilitating the untwisting of the wire cord of an ordinary desk telephone.

1,255,250. Recording Mechanism; James C. Warren, Emporia, Va. App. filed Jan. 11, 1916. Recording elements are operated by electromagnetic means.

1,255,264. Terminal Coupling for Electrical Conductors; Charles W. Wright, Topeka, Kan. App. filed July 29, 1915. Improved connector.

1,255,277. Electric Fire and Burglar Alarm; Lewis E. Bates and Vollie V. Hanks, Houston, Tex. App. filed Nov. 10, 1916. The relay and the permanent magnet associated therewith are so utilized that a very small amount of energy will be required.

1,255,289. Art of Utilizing High-Frequency Electric Oscillations; David W. Brown, New York, N. Y. App. filed Aug. 9, 1916. Improvements.

1,255,310. Wire-Engaging Battery Terminal; Albert E. Henderson, Middleton, Mass. App. filed March 15, 1917. Eliminates the binding post and screw.

1,255,326. Electrical Heating Unit; Arnold N. Macnicol, Melbourne, Victoria, Australia. App. filed June 16, 1914. Parts of which are readily detachable and renewable.

1,255,374. Telephone System with Universal Cord Circuit; Charles S. Winston, Chicago, Ill. App. filed July 30, 1914. Improvements.

1,255,387. Protective System for Electrical Apparatus; Lewis W. Chubb, Edgewood Park, Pa. App. filed Jan. 5, 1916. Energy-absorbing means which are adapted to be connected across the terminals of the apparatus to be protected.

1,255,400. Dynamo-Electric Machine; Ralph E. Ferris, Swissvale, Pa. App. filed Aug. 7, 1914. Arrangement of magnetic field circuits.

1,255,418. System of Control; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed Sept. 21, 1915. Control of electric motors that are adapted for the propulsion of vehicles during the accelerating periods thereof.

1,255,419. Control System for Dynamo-Electric Machines; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed Nov. 29, 1915. Method whereby motors may be accelerated and otherwise controlled in a smooth and uniform manner and with substantially sparkless commutation.

1,255,437. Electrodeposition of Metals; Frederick Laist and James O. Elton, Anaconda, Mont. App. filed June 16, 1916. Provides a simple means for determining the efficiency of the purification and the suitability of the solution for electrodeposition of the metal.

1,255,439. Process of Recovering Zinc from Ores; Frederick Laist and James O. Elton, Anaconda, Mont. App. filed July 10, 1916. Improvements.

1,255,440. Process of Treating Complex Ores or Concentrates Therefrom; Frederick Laist, Anaconda, Mont. App. filed Nov. 3, 1916. Improvements.

1,255,441. Alternating-Current Electromagnet; David C. Larson, Yonkers, N. Y. App. filed Dec. 1, 1915. Consists in the proportioning of the secondary conductor and in the construction and relative arrangement of the core and conductor.

1,255,445. Regulating Mechanism for Arc Lamps; George M. Little, Pittsburgh, Pa. App. filed Feb. 3, 1915. Improvements in the clutching and regulating mechanisms for such lamps.

1,255,447. Motor-Control System; Walter O. Lum, Wilkinsburg, Pa. App. filed April 24, 1913. In which starting resistors are controlled by sets of automatically operated switches.

1,255,457. Dynamo-Electric Machine; George H. Murray, Jr., Wilkinsburg, Pa. App. filed Nov. 6, 1914. Relates to amortisseur windings.

1,255,475. Control System; Karl A. Simmon, Wilkinsburg, Pa. App. filed Dec. 4, 1913. Protective means for avoiding the effects of abnormal conditions in certain of the control apparatus.

1,255,486. Dynamo-Electric Machine; Norman W. Storer, Pittsburgh, Pa. App. filed May 22, 1913. Special reference to railway motors of the twin-armature type.

1,255,487. Dynamo-Electric Machine; Norman W. Storer, Pittsburgh, Pa. App. filed May 11, 1914. Direct-current railway service.

1,255,517. Starting and Current-Supplying System for Automobiles; Thomas A. Edison, West Orange, N. J. App. filed July 31, 1912. Improvements.

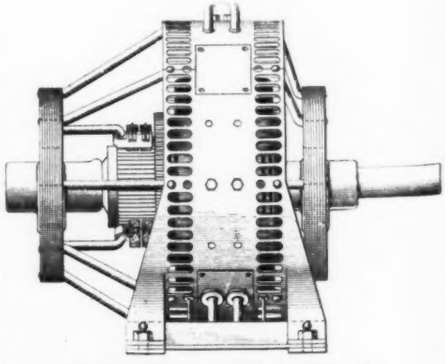
1,255,531. Electrical Snap Switch for Water-Purifying Apparatus; Harry B. Hartman, Scottsdale, Pa. App. filed Nov. 8, 1915. Automatic type.

1,255,535. Electrical System for Distribution; John W. Jepson, Depew, N. Y. App. filed Jan. 21, 1914. Car-lighting systems.

1,255,536. Galvanic Battery; Heinrich H. M. Kammerhoff, Orange, N. J. App. filed Feb. 9, 1914. Improved arrangement whereby the necessity of insulating from each other the conducting containers of a pair of storage-battery cells composing a battery is obviated.

1,255,541. Casting Machine for Dental Work; Sigmund M. Lauter, Brooklyn, N. Y. App. filed July 3, 1914. Improvements.

1,255,552. Switching Mechanism; Carl P. Nachod, Louisville, Ky. App. filed Sept. 18, 1914. The closure or opening of an electric circuit or plurality of electric circuits is effected in response to different relative angular positions assumed by members stepped or otherwise rotated in like directions.



1,255,606—Dynamo-Electric Machine

1,255,589. Turbine-Driven Electric Generator; Arthur S. Dysart, United States Navy. App. filed Dec. 21, 1916. Provision of novel means for collecting the current from the rapidly revolving rotor or armature.

1,255,606. Dynamo-Electric Machine; William T. Hensley, Connersville, Ind. Improvements.